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THE SAWYER-MAN ELECTRIC LAMP.

The practical usefulness of the electric light for illuminating open spaces and wide areas has been amply demonstrated by the various devices for using the electric arc already widely employed. Hitherto, however, it has not been found economical, or even possible, as we understand it, to construct a lamp or candle, based on the electric arc, that would answer the requirements of ordinary domestic and industrial lighting, where a moderate amount of light, well distributed, easily manageable, and of perfect steadiness and softness, is needed. The electric arc seems, from its very nature, to present insuperable obstacles to the economical production of a large number of small lights in a circuit; in other words, such lights as we require in our dwellings, offices, factories, shops, and the like. And if there were no other means of obtaining light from electricity, the probability of the displacement of gas by it, for the purposes of general illumination, would hardly be worth considering.

The production of light through the incandescence of a pencil of carbon or metal, forming part of an electric circuit and highly heated by its internal resistance to the passage of the electric current, offers an entirely different field for exploration; and though it has long been apparently closed by the failure of early attempts to obtain an electric light by such means, the achieved success of Messrs. Sawyer & Man, not to speak of the reported success of Mr. Edison, clearly indicates that this is the line along which the practical solution of the problem of household illumination by electricity is to come. The lamp, to be described further on, lacks only the practical demonstration of its economy by protracted use on a large scale, to compel acceptance as a successful solution of the problem.

So long ago as 1845, an American inventor, Mr. King, patented here and in England a lamp (said to have been invented by J. W. Starr) involving this principle. His light was produced in a vacuum, to prevent the oxidation of his incandescent carbon or metal, and was extremely promising for its beauty, brilliancy, and steadiness. But it failed to be permanent and economical from various defects and deficiencies, some of which have been removed by the increased power and economy of modern dynamo-electric machines, and by recent advances in the art of subdividing the electric current, but the most of them by the inventions and discoveries covered by Messrs. Sawyer & Man's patents.

The economical division of the current, or more correctly the light produced by a single current—popularly believed to be very difficult if not practically impossible—has been successfully worked out by several American investigators. As long ago as 1875, Mr. Moses G. Farmer, now Electrical Superintendent of the U. S. Naval Torpedo Station, at Newport, R. I., subdivided the electric current, produced by a small machine, into forty-two different branches, putting a light to each branch. Mr. Sawyer's system appears to be able to do the same indefinitely through the maintenance of a uniform resistance throughout the circuit and equal resistances in the several parts of the circuit, as will be shown further on.

The adaptability of this form of electric lighting to the needs of household illumination is indicated in Fig. 1. The light produced is pure, strong, and yet soft, like sunlight. It is, moreover, steady and cool. It is not influenced by air currents; and it does not vitiate the air by poisonous products of combustion, nor by withdrawing the vitalizing oxygen. The lamp takes up less room than the glass shade of a gas jet, and no more than the chimney of an oil lamp. To a limited extent, also, it is portable, and may be used as a drop light. The general appearance of the lamp is shown in Fig. 2 (page 354). The light is produced by the incandescence of the slender pencil of carbon placed as shown in the engraving. The light-giving apparatus is separated from the lower part of the lamp by three diaphragms, to shut off downward heat radiation. The copper standards lower down are so shaped as to have great radiating surface, so that the conduction of heat downward to the mechanism of the base is wholly prevented. The structure of the base, full size, is shown in Fig. 3 (page 355). No detailed description of this portion will be required, further than to say that the electric current enters from below, follows the line of metallic conduction to the "burner," as shown by the arrows, thence downward, on the other side, connecting with the return circuit. The light-producing portion is, of course, completely insulated, and also sealed at the base, gas tight.

A fatal defect in all previous lamps depending on incandescent carbon has arisen from what has been called the "vaporizing" of the carbon. This Mr. Sawyer holds to be an absurdity, since the carbon is not even fused. The wastage of the carbon in mercurial vacuums, and in atmospheres of compound gas, is due, he holds, to chemical decomposition. Many gases, indifferent to carbon at ordinary temperatures, attack it destructively at temperatures obtained in the electric lamp; and the process is continuous, the carbon taken from the burner being redeposited on the glass case, and the gas left free to continue its depredation. Mr. Sawyer claims to have overcome this difficulty by his method of charging the lamps with pure nitrogen, and by providing for the fixing of any residual oxygen left in the lamp. In this way an unwasting carbon is secured. Another stumbling block on which other workers in this field

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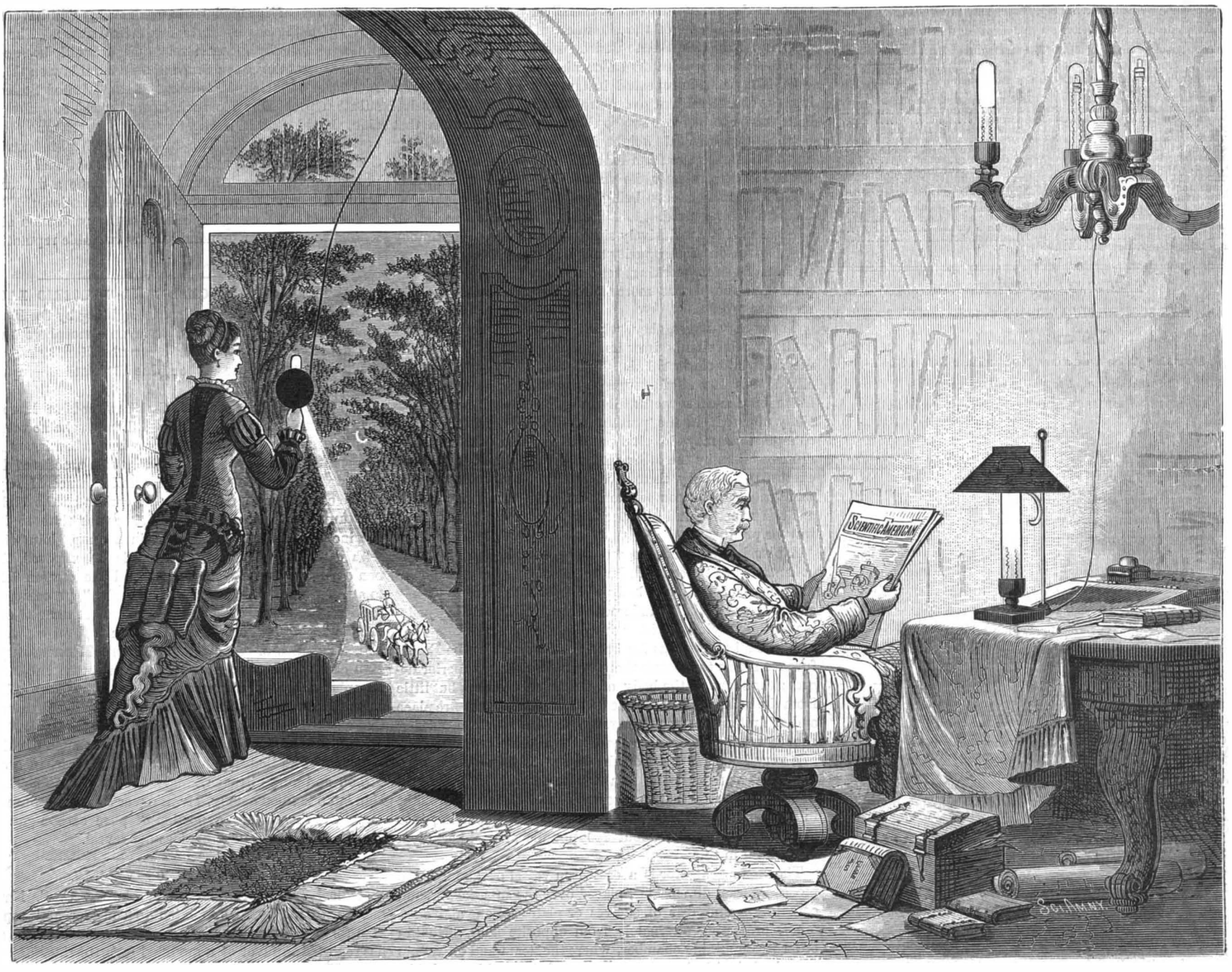

THE SAWYER-MAN ELECTRIC LIGHT.

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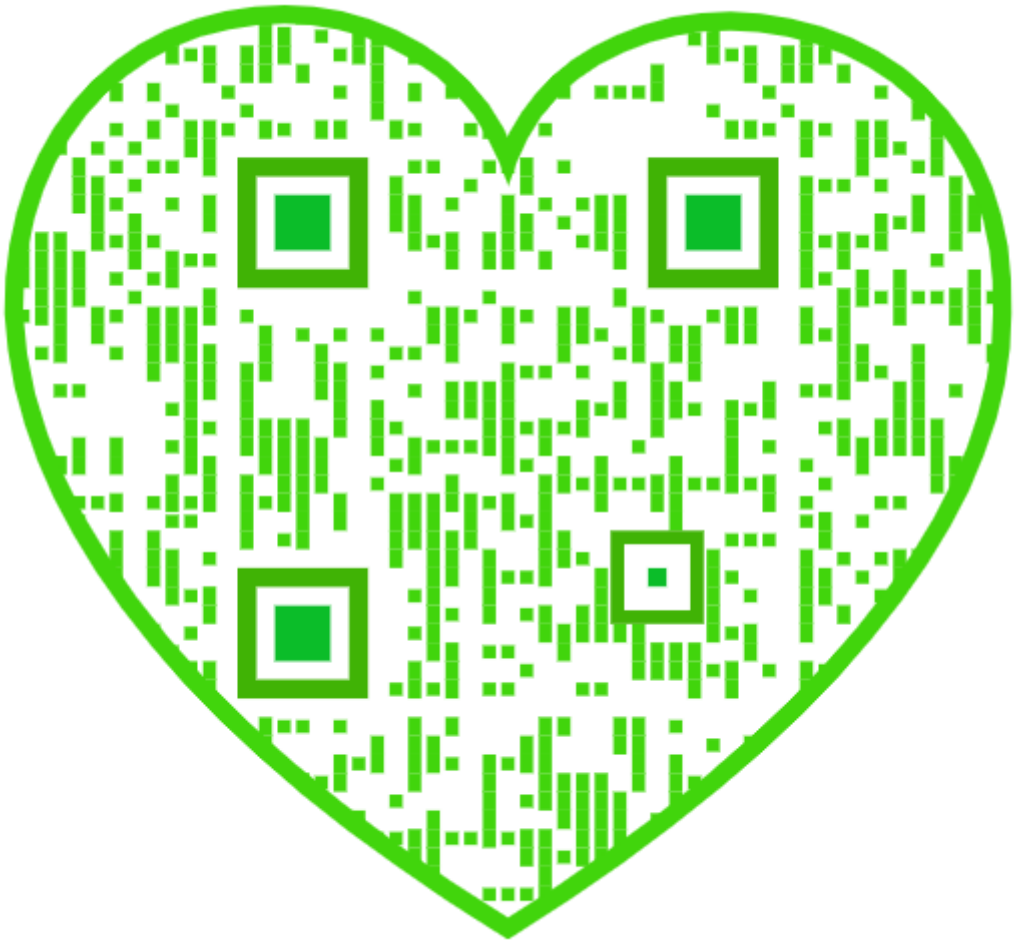

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THE UTILIZATION OF PETROLEUM.

In an article on the outlook in the petroleum region, a late number of the *Petroleum Reporter* says: "When we see Europe so stocked and filled with the product that the values have gone below any point heretofore reached within the history of the trade, and when, in addition to this, we see a greater activity in the producing region than has ever before been known to continue and enlarge the over-production, it is little less than absurd to hope for any result except bankruptcy to the producer."

With home and foreign markets filled to repletion; with an increasing production both here and abroad; with the price lower than it has been for sixteen years ($1.06 per barrel, or about 2½ cents per gallon, delivered free on board), and a stock on hand in the producing region of nearly five million barrels, the prospects of the producers are so gloomy that it is with but little surprise that we learn that the proposition to decrease the amount held, in the hope of enhancing the value of that left, by emptying most of it into the river or burning it up, has been seriously advocated by some of them. Such a plan, however, would serve to stimulate increased production, and defeat the desired object.

A remedy for these conditions cannot be found in a day; they will doubtless continue for a long time.

The producers and holders of petroleum have for years been too much occupied in getting and accumulating, and have given too little attention to the possible ways of disposing of it. New applications, new uses for the product, are imperatively necessary to restore a healthy tone to this industry. Some plan must be discovered by which the consumption shall be made to keep more even pace with the production.

Already we are witnessing the beginning of a great change in the manufacture of illuminating gas, which, though in its infancy, and opposed at every step by watchful and persistent coal gas monopolies, will eventually afford a broad outlet for this oil. The consumption of three gallons or thereabouts of petroleum per one thousand feet of gas by the new processes, whose success has been fully demonstrated in Baltimore, Philadelphia, and many other places, is a matter, we should think, of sufficient importance to assure the co-operation of the oil producers in extending the benefits of the processes and defending them against the present gas monopolies.

But it is especially in the application of petroleum as fuel to metallurgic and other purposes that sufficient and permanent relief can best be secured, and it is a matter of great surprise that the oil producers have paid so little attention, have been so indifferent, to the results obtained and progress made in the use of this fuel in metallurgy, and to the accumulating evidence of the accuracy of the predictions of Rankine, Prideaux, Sainte-Claire Deville, Wurtz, and scores of other able investigators concerning it.

Of late years, in repeated instances of continuous working, the actual efficiency of petroleum in firing boilers has been shown to be from two to three times greater than that of the best solid coal, weight for weight, and in puddling and heating furnaces from four to six times greater, while in steel melting furnaces its superiority is still more manifest, its thermal effects being more decided the higher the temperature required.

Besides, it is conclusively shown by a mass of testimony that, by reason of the purity and intensity of its flame, petroleum, in iron working, removes the contaminating sulphur and phosphorus more thoroughly even than the Siemens gas process.

These advantages, then, which petroleum possesses over coal, must inevitably draw its producers and the iron manufacturers into closer relationship, where they will be mutually dependent and of mutual benefit to each other. But as iron manufacturers are at all times conservative and especially opposed, in the present condition of trade, to any change that may involve present expense, the initiative must be taken by the other party. The oil producers must exert a pressure by themselves building iron works, and demonstrate in open competition that they can manufacture and sell a better and cheaper iron than can in any other way be produced.

A petroleum furnace, to work successfully, should be so constructed as to secure intimate mixture of the gases, complete combustion in the body of the furnace, and a supply and pressure of the incandescent steam, air, and oil adjustable to the varying working conditions.

Above all others thus far brought to our notice the Eames furnace seems to possess these requisites in a superior degree; the shape of the body of the furnace differs but little from the ordinary iron furnace, but in place of the fire place and ash pit are a vapor generator, a superheater, a mixing chamber, and a combustion chamber, while in close proximity, as a very important part of the apparatus, is a small force pump. The superheater is a double casting, inclosing the fire, so chambered that the steam which enters it is brought in contact with ample heating surface before passing into the vapor generator, about 150 pounds of coal per diem being used in this.

The vapor generator is a cast iron vessel of about 18x30 inches internal dimensions, placed over the superheater, and containing a number of shelves or plates set one above another, projecting alternately from opposite sides. Next in order is the mixing chamber, where the steam and oil vapors are mingled with the proper amount of air; and beyond this, occupying the place of the usual bridge wall, is the combustion chamber, which is an indispensable part of the apparatus, though it consists simply of a cellular tier of fire bricks placed on end and having a horizontal thickness of 18 inches Within these cells the combustion begins.

From a tank placed in any convenient position the pump draws the petroleum, and forces it, at about 10 lbs. pressure, into the vapor generator in a very slender stream, where it flows downward in a thin layer, dropping from shelf to shelf. It thus meets the opposing current of superheated steam which passes upward from the superheater; thence the combined vapors or gases pass through a pipe to the mixing chamber to receive the required amount of air, and from this into the cellular combustion chamber, where begins the combustion which is completed in the furnace itself.

The experience of all users of petroleum fuel has shown that the superheating the steam, vaporizing the oil, and the mixture with air must, in order to insure complete combustion, be done before they reach the furnace; and we consider the Eames arrangement to be admirably adapted to that end.

For the purpose of guaranteeing absolute safety in the use of this fuel, the pump is fitted with what is called an equalizing valve, which absolutely regulates the flow of the oil into the generator, and, at the same time, interposes an insurmountable obstacle between the generator and oil tank to any chance reaction of gases or flame. Pressure gauges on the oil feed pipe and on the generator serve to give further security in the manipulation of the apparatus.

Success in this direction rests upon clearly defined general principles, which, in this instance, are well understood and applied; and the result offers to oil producers an extensive use for their product, and to the iron manufacturers the way to make better and cheaper iron.

A TRADE MARK DECISION.

During the four years in which the United States trade mark law has been in force, the question of its constitutionality has not been raised in the courts until quite recently. In the case of Leidersdorff & Co., tobacconists, to enjoin Flint & Co. from the use of certain labels, the defendants demurred, and held that the court had no jurisdiction. In his decision, November 12, Judge Dyer, of the United States Court, Milwaukee, Wis., sustained the demurrer, deciding that the constitutionality of the trade mark statute cannot be sustained under the clause which gives to Congress the power to regulate commerce among the several States, nor under any other of the provisions of the Constitution prescribing the legislative power of Congress.

In case this decision is sustained by the Supreme Court, the owners of invaded trade mark rights will have to fall back upon the State courts for their defense. The actual protection against commercial piracy will be no whit lessened; yet the convenience of a national law on this point is so great, that an amendment of the United States Constitution providing for such issues would be quite justifiable, should that instrument prove to contain no provision now for such a law. The experience of all industrial nations has proved the need of some such national means for protecting trade marks. It has also become a matter of international comity; and as an industrial nation the United States cannot afford to lag behind in the protection of those who have earned an honorable and profitable reputation for their manufactures.

THE WASTAGE OF CARBON IN ELECTRIC LAMPS.

One source of failure in electric lighting by the incandescence of carbon in a vacuum, or in an atmosphere furnishing no recognized supporter of combustion, has been the gradual wasting of the carbon, due to volatilization according to received explanations.

The electrical inventor of the Sawyer-Man lamp says that this explanation is erroneous; there can be no volatilization under the circumstances, since the carbon is not fused. The wastage is due, he says, entirely to a process of decomposition and recomposition, the smallest trace of any substance capable of uniting with the carbon at the high temperature of the electric light sufficing with time to destroy the incandescent carbon. Thus in a lamp globe charged with carbonic CO or CO_2, the gas is decomposed, the carbon deposited on the cooler glass, and the oxygen left free to attack the carbon; and this "circular" process goes on so long as the light is kept up, the minutest trace of oxygen sufficing to destroy any mass of carbon.

In the course of extended experiments Messrs. Sawyer & Man claim to have positively ascertained that sulphur and phosphorus are equally as destructive of the carbon burner as oxygen; that chlorine is fatal to it, and hydrogen; and that any compound gas whatever, even in the smallest quantities, is sure destruction to carbon under such conditions. The only gases that will not combine with carbon are pure carbon and pure nitrogen, singly or together. The Sawyer-Man lamp is filled chiefly, Mr. Sawyer says, with pure nitrogen. Yet there is also a portion of pure carbon gas. The secret of the preparation he does not reveal.

VENTILATION OF VESSELS.

Medical Inspector, Thomas J. Turner, U. S. Navy, a member of the board appointed to consider and report a plan for the better ventilation of the vessels of the navy, has reported in favor of a modified form of the Napier system. Next to securing a larger supply of pure air, Mr. Turner insists on drier air. The unwholesomeness of the air of the berth decks is increased by its excessive humidity,

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which has its origin almost entirely in the daily water soaking routine which exists in the service. He says:

"If this routine washing, holystoning, wiping, clamping, scrubbing, etc., is meant for cleanliness, an obvious inference therefrom would disrate the Augean stables from their billets as the pre-eminent examples of filth, and our vessels would be promoted to that unenvied rating."

The berth decks should be kept dry, and the seamen supplied with wholesome air; in this way two of the most potent of disease producing agencies of ship life will be removed.

THE LARGEST CASH VAULT IN THE WORLD.

The new bullion vault for the Sub-treasury, corner of Nassau street and Wall street, New York, is said to be the largest of its kind in the world. It is situated in the west basement, immediately under the coin room, with which it is connected by an iron stairway and an iron elevator, worked by hydraulic pressure.

The vault is surrounded by a granite wall seven feet thick, with an inner wall, roof and floor of iron and steel, between two and three inches thick. It is entered by two stout iron doors, each of which has two combination locks; the outer door being also guarded by a chronometer lock. The unlocking of either of the combination locks opens the door, two being used to prevent the trouble liable to occur through the derangement of a single lock. The vault is 48 feet long by 28 feet wide and 12 feet high; and is divided into several compartments by iron railings. It cost about $25,000.

INCREASING TRADE WITH CHILI.

Through the efforts of Postal Commissioner Fralick, the attention of the merchants of Chili has been called to the vast manufacturing resources of this country, and an encouraging impulse has thereby been given to this department of our export trade. According to the Philadelphia *Record*, a member of a large Valparaiso firm having a branch house at Hamburg, Germany, was induced by Mr. Fralick to visit Philadelphia, where, after an inspection of a large number of industrial establishments, orders were left for nearly $100,000 worth of goods. November 18, the first installment of these orders was carried out by a Swedish bark, whose manifest showed, among other goods, 104 cases galvanized and corrugated iron, 3,341 bars and 204 bundles bar iron, 834 kegs nails, 309 bars cast steel, 14 cases saws, 2 cases hardware and tools, and 68 dozen shovels. She also has on board, 4 bales drygoods, 1,000 gallons refined oil, 330 tons bituminous coal, 12 gross chains, 100,000 feet of lumber, 12 gross hats, 100 dozen mining sledges, 125 dozen brushes, and 22 cases Vienna bread.

AMERICAN CONTRIBUTIONS TO MODERN ARTILLERY.

In a very timely article on the weakness of the United States in the matter of heavy artillery, the *Army and Navy Gazette* remarks that although miserably armed, we have the skill to make the best guns, and our citizens have contributed the leading principles of gun construction on which all modern European systems are based. In proof of this position the journal discusses at considerable length the advantages of the American system of rifling, Rodman's pressure gauge for gunpowder and the influence it has had on powder making and gun construction, the advantages of expanding projectiles, and the chambered gun, all of which have been appropriated by European nations; and then goes on to say: "It is rather startling to see the skill of one nation so deftly appropriated by others, and the first nation neither keeping the skill within its own territory nor apparently caring to keep pace with modern progress. There need be no foreign military attachés at Washington, because our inventors seem to get away as fast as possible and sell everything valuable to foreign governments."

If the United States do not take steps to put our coast cities in a proper condition of defense, the *Journal* insists we shall not only remain as we now are, unwarrantably exposed to attack, but in a little while everything that we have invented will come back to us with a foreign name.

"Our mammoth powder will become 'pebble,' and perforated cake be known as 'prismatic;' our pressure gauge as a 'crusher gauge,' and the Hotchkiss case shot be credited to Colonel Boxer. Professor Treadwell's system of gun construction, of 1840, is known as Armstrong's, of 1856, but no one has seen Armstrong's patent for it. Krupp has appropriated the Broadwell system bodily, and Eastman's slotted screw breech plug is known as the French breech loading gun. The Russian government built a great foundry at Perm to carry out Rodman's designs on a large scale, and took his powder and his experience along. Mr. S. B. Dean invented a method of mandreling bronze guns by which strength and hardness are greatly increased, and two years after his patents were taken in Austria, his gun was brought there as the Uchatius gun and a vast achievement. Their whole artillery is armed with it. Mr. Parsons has shown how the strongest guns may be made with steel tubes and cast iron exteriors. Mr. Hotchkiss has gone to France and established a large factory near Paris, where he has very extensive orders, and has become, in his line, the main reliance of the French government."

THE FUSING OF CARBON.

The carbons of the Sawyer-Man Lamp present several peculiar features, notably a bright gray metallic luster, and extreme hardness. The inventors found existing carbons to be insufficiently homogeneous, and liable to disintegration by heat; so they devised the new form, but do not disclose the method of its preparation. These carbons whiten with protracted use, and also increase in hardness; they appear to have been originally formed at a temperature approaching fusion.

Before proper means for regulating the current to the lamps were devised it was no infrequent thing for a lamp to come to grief through an excess of electricity. In such cases the carbon pencil would soften and double up by its own weight. In a note with reference to such accidents Mr. Sawyer writes us as follows: "Professor Barker, of the University of Pennsylvania, assured me that I was the first to have fused carbon. If this is so, I can assure you that nothing is easier. If the carbon pencil cannot chemically combine with the atmosphere contained in the globe of our lamp, when too much current is given it, it must either burst or fuse; and it never bursts." Whether the fused carbon could be made to crystallize as diamond, Mr. Sawyer does not pretend to say; one thing, however, is certain, a diamond so formed would cost all it was worth.

ALUM IN BAKING POWDERS.

To the Editor of the Scientific American:

Prof. Henry A. Mott, Jr., in your issue of November 16, has favored the readers of the SCIENTIFIC AMERICAN with an interesting article on the above subject.

The large and widespread use of baking powders as substitutes for yeast in various kinds of cookery renders this question one of interest and importance to every one.

As a matter of fact, however, your former correspondent has put the subject in a more formidable shape, and has given your readers a greater "scare" than the actual facts of the case will warrant; and as the question is one that is sure to excite more or less discussion in your columns, a little chemistry on the subject here may not be amiss.

No one will deny for an instant that alum by itself has a powerful effect upon the membranes of the human system. If he has any doubt on the subject, let him taste a minute particle. Even when taken in the smallest quantities—so small that it cannot be tasted in the bread—it may be more or less injurious, especially when taken successively for a continued period, as would be the case with the daily customer of any baker using it. The behavior in this way of mere traces of various salts upon the system is well illustrated in the case of drinking waters, as almost every one has experienced in the change of water involved in traveling, visiting summer resorts, etc.

The presence of alum in bread, therefore, cannot but be open to objection.

The presence of alum in baking powders is a question altogether different; a point which seems to be overlooked in nearly all articles on this subject.

The second active ingredient in baking powders is bicarbonate of soda, generally present in quantities equal in weight to the alum present (as shown by Professor Mott's analyses).

Alum being a salt with an "acid reaction" (to speak technically), acts on the soda in the same way that a free acid would. Both the soda and alum are completely and entirely destroyed as such, the results of the reaction being:

1. Carbonic acid gas; the agent that causes the bread to "rise."
2. Sulphate of soda.
3. Precipitated and insoluble alumina.

None of these three have any more resemblance to alum, in their appearance or behavior, than they have to quinine, sugar, or common salt.

One might as well suppose that because caustic soda (better known as "concentrated lye") is a powerful and strong alkali, therefore soap, which is made largely from it, would be a dangerous article to have about on our washstands. Or that because muriatic acid is a very disagreeable and corrosive acid, therefore common salt (which can be made from it and the above caustic soda) should be banished from our salt cellars.

But we have not yet reached the root of this matter. The question still to be settled is: Have these three resulting compounds in the bread any action upon the system, and if so, of what nature is their action?

As already stated, the results of the reaction are (1) carbonic acic, (2) alumina, and (3) sulphate of soda.

The first is, of course, the same as the carbonic acid from yeast, or from any baking powder.

The alumina is a white, gelatinous, insoluble substance, which is scarcely, if at all, dissolved by the weaker acids, especially after having been heated, and would, therefore, most probably pass through the system, unaffected by the juices of the stomach, as a simple inert substance. The total amount present is about one-tenth of one per cent. of the weight of the bread.

The sulphate of soda has precisely the same action upon the system that the Rochelle salt resulting from the cream of tartar-baking powder has. With this exception, that the former is somewhat stronger in its action, both belonging to the class of bodies known as "purgatives." *

So that it may be truthfully and conscientiously stated that whatever effect a "cream of tartar" baking power may have upon the system, an "alum" baking powder will likewise have, only in a somewhat higher degree; and that alum in bread, and sulphate of soda in biscuits, are two utterly and entirely different questions.

* See United States Dispensatory. The small percentage of sulphate of potash, or of ammonia, present (according to whether the alum used is potash or ammonia alum), will not alter the result. The potash salt is also a mild purgative. The action of the ammonia sulphate is not given.

It is frequently the case that many inventions and new articles of commerce, although possessing much intrinsic value, have to come in contact with popular prejudice or a sort of "orthodox" scientific opposition, resulting from a mistaken or partial view of the question.

Such was the case with artificial butter, and also with the much discussed "carbonic oxide" in water gas. It appears to me that the subject of this article is a chip of the same block.

It seems hardly a compliment to the common sense of our American manufacturers, that they should be credited with putting forth an article used almost daily in many households, that has properties so virulent and effects so injurious as the "popular" view of this subject would lead us to suppose it possesses. Yours, etc.,

Phila., Pa., Nov. 9, 1878. HENRY PEMBERTON, JR.

[In the article referred to by Mr. Pemberton—an article, we may add, evidently written by Dr. Mott in the interest of the Royal Baking Powder Company—the writer was clearly at fault. Finding alum in the baking powders named, Dr. Mott leads the reader to infer that there must be alum in the biscuits made therewith. This inference, as Mr. Pemberton shows beyond a doubt, is altogether wrong; the chemical process of baking causing the total disappearance of the alum as such, the resulting compounds being either wholesome or inert. The certificate of Professor Doremus, given below, shows that biscuits made with the Dooley Baking Powder, and presumably also with other powders of the same kind, contain neither alum nor any other deleterious substance. Moreover, the manufacturers of Dooley's Baking Powder inform us that the alleged analysis of their powder, given by Dr. Mott, does not correctly represent the composition of that article.

Those who know the gentlemen in question will not need to be told that they would not be guilty of making and selling for public consumption an article either adulterated or injurious. The whole matter, indeed, seems, on examination, to resolve itself into a rivalry between different methods of producing baking powders; and in lauding one form, at the expense of another equally wholesome, Dr. Mott, we fear, lays his communication justly open to the criticism in the letter of our Colorado correspondent printed herewith. —EDS. SCI. AM.]

Dr. Doremus' Opinion of the Dooley Baking Powders.

BELLEVUE HOSPITAL MEDICAL COLLEGE,
New York, November 15, 1878.

This is to certify that I purchased of Mr. S. H. Williamson, 26 Broadway, a can of "Dooley's Baking Powder;" that I had biscuits made therewith; that I have analyzed the same; and that they do not contain alum, or any other deleterious substance. R. OGDEN DOREMUS, M.D., LL.D.,
Professor of Chemistry and Toxicology in the Bellevue Hospital Medical College.

Alum in Baking Powders.

To the Editor of the Scientific American:

In your issue of November 16, Henry A. Mott, Jr., professedly for the benefit of the "dear public," gives an analysis of four different makes of baking powders, and recommends the use of only one (the Royal), whereas he claims to have analyzed forty-two different kinds, 50 per cent of which he says contain deleterious substances. Now, why, if Mr. Mott is so zealous for the public good, could he not have given the whole forty-two analyses and left out a little of his elucidations? It would have taken up very little more space in your columns, and would have looked less like an advertisement of the Royal Baking Powder.

Now, I do not doubt that the analyses given are correct, otherwise he would not have dared to publish them, but in justice to all manufacturers and the true good of the public, let us have the full list. PRO BONO PUBLICO

Boulder, Col., Nov. 14, 1878.

A Golden Meteorite.

The Yuma (Cal.) *Sentinel* describes as a "meteorite" a specimen lately picked up in the Mohave desert and brought to Fort Yuma. According to the *Sentinel*, "it weighs about a pound, and carries free gold, of which nearly a dollar appears on the surface. It is not magnetic, and has successfully resisted simple and compound baths of acid. In this respect it resembles specular iron, but in no other. One of its surfaces shows a fracture that reveals a crystalline structure, the color of which is a steel gray, tinged with yellow. It has defied the best cold chisels in the blacksmith shop, and has not broken or chipped under heavy blows. If its composition can be imitated it will produce the hardest and toughest alloy known."

Utilizing Old Rails.

A new use for old rails is being put to practical test at the workshops of the Prince Edward's Island Railway Company. The plan of the bridge is a lattice girder, 31 feet span. The top chord is formed of three rails laid parallel; the bottom chord is formed in like manner, the lower rails being placed in an inverted position. The diagonal bracing is formed of short pieces of rails, bent at the upper and lower ends, and twisted with a half turn in the middle, so as to cause the flanges to come in conjunction with the flanges of the top and bottom chords. The flanges are then riveted together with ⅜ inch rivets. At each place where the braces and counters meet the chord a ½ inch iron plate is introduced, which binds the three rails of the chord together. The rails used are 40 lb. iron of the Sandberg pattern.

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THE SAWYER-MAN ELECTRIC LIGHT

[*Continued from first page.*)

have come to grief, has been the crumbling or disintegration of the carbon burner, due to sudden heating when the lamp is lighted. This is avoided in the Sawyer-Man lamp by an ingeniously devised switch, shown in Fig. 4. By this means it is impossible to turn the current on or off suddenly, to the disruption of the carbon. This, however, is not the only nor the chief advantage of the switch. It is, indeed, the key to the entire problem, the indispensable condition, Mr. Sawyer holds, of practical electrical distribution.

It is well known that an electric current will exactly and readily divide among circuits of equal resistance. Accordingly, if the resistance of a subcircuit be maintained constant, no matter what may be going on in it, whether a lamp is not lighted at all, or lighted to a mere taper, or to any intermediate stage up to full brilliancy, it is obvious that no other lamp or lamps in that circuit will be affected. The operation of the switch, in securing such uniform resistance, is shown in the accompanying diagram, Fig. 5 (page 355).

The lamp has, let us say, a resistance of 0·95 of an ohm. Therefore if one lamp is out there should be a resistance of 0·95 of an ohm in its stead. This is the shunt resistance, B. The current enters at the "+" point, and leaves at the "—" point. The contact piece, A, bearing upon the two studs, 1, 1, all the current passes out by way of B. When A is moved to the studs, 2, 2, the current divides, ¼ going through the lamp, the other ¾ by way of B, and the resistance of the combined circuit is $0{\cdot}31\frac{2}{3}+0{\cdot}95=1{\cdot}26\frac{2}{3}$ in the shunt; and $1{\cdot}9+0{\cdot}38+25\frac{1}{3}+18\frac{2}{3}\frac{2}{1}+0{\cdot}07\frac{5}{12}+0{\cdot}06\frac{1}{3}$+(the lamp) 0·95=3·8. The resistance of the circuit is, therefore, $\frac{1{\cdot}26\ 2{\cdot}3\times 3{\cdot}8}{1{\cdot}26\ 2{\cdot}3+3{\cdot}8}=0{\cdot}95$ of an ohm, and so on. In short, the resistance of the circuit is constant at 0·95, no matter what may be the change in the proportion of the current given the lamp, as may be seen by making the required calculation for each pair of studs. The varying resistances required to give the best effect have been worked out by practical trial. The effect of ¼ the current through the lamp is to make the carbon a dull red. On studs 3, 3, one half the current passes through, and the carbon becomes a bright red. On studs 4, 4, the lamp gets ⅝ of the current, and becomes white hot. On 5, 5, the lamp gets ¾ of the current, and begins to assume the intense limpid incandescence of the sun; and the light increases rapidly with subsequent changes until the whole current goes through the lamp.

Thus it is seen that the greater part of the illumination is the product of a small part of the current. When the light is well on, a very slight increase in the current increases the light enormously. It is here that the great loss occasioned by dividing a fixed current among several lamps finds its explanation. A current that suffices in one lamp to produce a light, say of 100 candles, will, if divided between two lamps, give in each perhaps no more than 10 candles, or even 5, making a loss of 90 candles in the sum total. But if the current be doubled, each lamp will give a light of 100 candles, and the sum total will be 200 candles instead of 10. Having brought a candle or a system of candles up to the point of feeble incandescence, a (proportionally) small addition to the current will make them all brilliant. If at 6,000° Fah. a given carbon will produce a light of 3 candles, at 12,000° it will give 9 candles, and at 24,000° it will give 81 candles; the illuminating power increasing with vastly greater rapidity than the temperature.

The wires supplying the current may be run through existing gas pipes, each lamp being provided with a switch placed conveniently in the wall; and by simply turning a key the light is turned up or down, off or on. So long as the house is connected with the main it makes no difference to the producer whether all the lights are on or off, since the resistance of the entire (house) circuit must be overcome; though it will to the consumer, since a meter records the time that each lamp is on, and the charge is rated accordingly. If the Dynamo-Electric Light Company can supply the illuminating force so cheaply that the constant and brilliant illumination of all the rooms of a house can be secured at no greater cost than the partial and intermittent illumination now had from gas, it is obvious that the electric light will score an important point. The cost of lamps and switches, it is claimed, will not exceed that of gas fixtures.

The meter above referred to is shown in Fig. 6. It is a simple clock arrangement, with an attachment designed to throw the dial hands into connection when a light is on. From each switch a pair of conducting wires are run to opposite studs on the wooden disk shown at the top of the figure. When no current passes through the lamp the revolving spring shown in front of the studded disk turns without making any record. When the current is on, one electric connection at each revolution is made through the pins assigned to the particular lamp, the armature of the magnet is moved, and the recording wheel is advanced one notch. This meter does not measure the quantity of electricity passing, but only the time a lamp is on. If two or any larger number of lamps are on, an equal number of connections are made at each revolution of the wheel, and the record wheel is advanced to correspond. This registration is, of course, a mere matter of business detail. In view of the well-founded popular dislike to gas meters, however, it would seem to be desirable to dispense with such devices entirely; and the nature of electric distribution appears to favor other and less objectionable modes and means of determining the financial relations of producers and consumers.

Figs. 7 and 8 indicate the method proposed for general distribution. Where the main is tapped for a sub-circuit, a shunt is introduced so as to throw so much of the current as may be needed into the derived circuit. The resistance of say 100 added lamps will be about 100 ohms. By giving to the shunt a resistance of one ohm, $\frac{1}{100}$ of the current will be diverted, and the lamps supplied. When a large number of lamps are required in a circuit, a combination of the two plans indicated is employed.

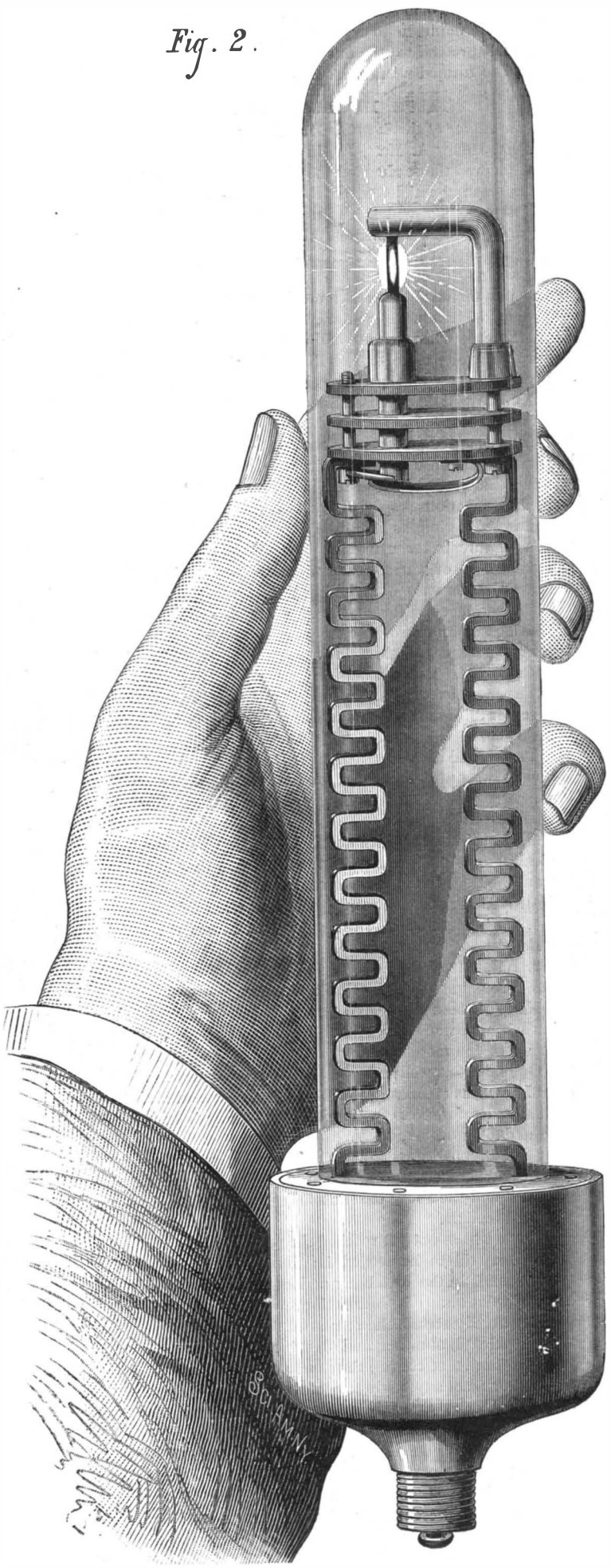
The diversion of any portion of the electric supply into an added circuit, whether one house or a group of houses, necessarily increases the aggregate resistance of the electric district, and calls for more work from the generator. To meet such contingencies automatically, Messrs. Sawyer & Man have invented and patented a regulator, which responds instantly to any increase or diminution in the demand, thereby securing an absolutely uniform volume of current.

This regulator so controls the steam or other power actuating the generator of electricity, that the amount of power supplied is increased or diminished in exact proportion to the demand, either by changing the volume of steam produced, or by coupling on or detaching different generators or parts of a single generator in circuit.

With regard to the cost of this mode of electric lighting no positive figures can be given. It is claimed to be entirely demonstrated that one horse power will give by the Sawyer-Man system of incandescence a light of 30 five foot gas burners an hour. Where large powers are employed the cost of steam power, every item included, is commonly rated at one cent per horse power per hour. The cost of 150 feet of gas at New York rates is 41 cents, which would make the gas over forty-fold dearer than the Sawyer-Man light. Mr. Sawyer does not stand on this estimate, however, holding that even if the electric light should prove in practice on a large scale to be ten times as costly as calculation indicates, it will yet easily compete with gas, the light furnished being so much better and purer.

It is promised that facilities will soon be offered for the photometric test of a large number of lights, in a circuit, with dynamometric tests of the power employed in generating the electric supply. This, as already noted, is all that the system lacks to prove itself an accomplished economical fact.

Fig. 2.



THE SAWYER-MAN ELECTRIC LAMP.

New Inventions.

Mr. Austin Connelly, of Hoboken, N. J., has patented an improved Faucet and Bushing, which consists of a faucet provided with a flanged nut for locking it into a permanent bushing screwed into the head of the cask or barrel, and a piston for removing the plug from the bushing, and other details of construction which cannot be fully explained without an engraving.

An improved Furrow Gauge Staff for Dressing Millstones has been patented by Mr. H. D. Altfather, of Maquoketa, Iowa. This invention is intended to provide, for the purpose of gauging the furrows of a millstone, an improved gauge staff by which all the furrows may be quickly gauged, and then cut exactly alike in width and depth.

Mr. Michael Dillmeier, of Dobbs Ferry, N. Y., has patented an improved Cigar Slitter. This is a simple and convenient pocket instrument for making a longitudinal slit in the mouth end of a cigar a little distance from the point, for making vent for the smoke.

An improvement in Packages for Bleaching and Packing Rosin has been patented by Mr. Addison D. Cutts, of Screven, Ga. This is a bilgeless barrel or package consisting of two longitudinal independent semicircular wooden sections, having semicircular end heads, and secured together by end hoops.

An improved Self-Feeding Water Trough has been patented by Mr. Alvin M. Brown, of Nettleton, Mo. This apparatus is so constructed as to keep a trough or tank supplied with water automatically for watering cattle for railway uses and other purposes.

Mr. John L. Nothaf, of Denison, Texas, has patented a Riding Saddle having an improved saddle tree, dispensing with the leather straps hitherto required for the girth-rigging, and affording a stronger and more durable rigging, that leaves the top and sides of the tree perfectly smooth.

An improved Harness Pad has been patented by Mr. A. L. Johns, of Fort Wayne, Ind. This pad has several novel features and is easily manufactured.

Mr. George W. Hooker, of Grand Rapids, Mich., has patented an improved Sled Brake, by which the sleigh may be fully controlled, as the brake is readily applied to the ground and taken off as required; and the invention consists of fulcrumed dogs that are operated by a crank shaft and hand lever arrangement.

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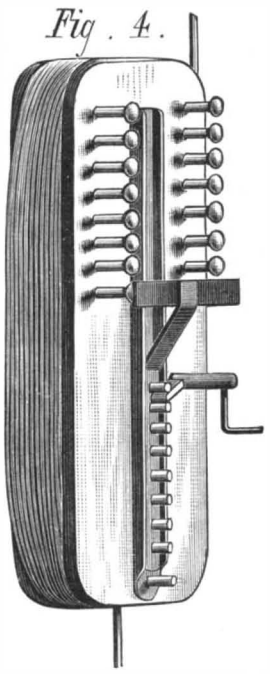
An improved Steam Cooking Apparatus has been patented by Mr. Martin Curtin, of Houston, Texas. This is an improvement in the class of culinary apparatus in which the heat of steam in pipes or tubular jackets is made to cook food without the direct action of fire by radiation, conduction, or convection.

Mr. Joseph R. Morris, of Houston, Texas, has devised an improved Table, designed to be heated by steam to keep the meat and other articles at the proper temperature. It consists more particularly in an arrangement of the steam heating apparatus that will admit of its application to dining tables, and will allow the plates of the diners and such of the dishes as may be desired being kept at the required temperature, without necessitating the heating of all the articles on the table.

Fig. 4.



THE SWITCH.

An improved Buckle Tongue Cover for Harness has been patented by Mr. Marshall R. Dowlin, of North Adams, Mass. The buckle tongue guard is made of one piece of leather, provided with two loops on the same side, and connected by an intermediate strip.

Mr. Peter Nussbaumer, of St. Louis, Mo., has patented an improved Vent Spike and Valve for Beer Barrels. This is a device for piercing the bungs of beer barrels, etc., for the purpose of admitting air to the interior, to allow the liquid to be drawn off at the faucet when the pressure of the gas in the barrel is not sufficient to cause the liquid to flow.

Simultaneous Inventors.

The Philadelphia *Ledger* thinks that inventors need not be jealous of rival discoverers, and suggests what we have often seen in our long experience with this class of persons, that the same inventions often emanate from different sources about the same time. The editor says:

"The discovery of discoverers is a well-known stage in the process of making public any new invention. From the statue to 'Ether' on Boston Common, which is popularly supposed to represent your choice among the men—one, both or all of whom gave the world its great anæsthetic—down to the rivalry of carbon button makers, Edison and Hughes, over the microphone, an instrument which has magnified in its own way the small proportions of the disputed point, even to the active Miss Hosmer herself, who has furnished motives for two claimants to announce themselves, whatever may be proved of the dynamics of her magnet, there need not always be suspicion of anything more than simultaneousness in honest claims. The air is charged with electric and magnetic hints, and, while so many minds are quick at seizing and following these, the wonder is not so much in the plurality of claimants, but rather that a discovery ever announces itself in singleness, when in workshops and laboratories patient investigators, to all of whom the same appliances are open, are making good use of the world's sum of knowledge. Mr. Gary, of Boston, however, who also has been prospecting in the magnetic field, and has been working ten years over it, has the manliness to say there may be other ways of arriving at his conclusion (that force and motive power may be produced from permanent magnets, with or without the aid of an electric battery); but that, if Miss Hosmer has made the discovery in his way, and before he did, he is ready to take a back seat. If she has made it later, but in a better way, his discovery will yield in competition to hers; if by an equally good though different road, there is room enough in the world for both of them. This has a refreshing sound about it, in contrast to the shrill warfare which some scientific opponents indulge in, and predispose one to read with interest what Mr. Gary says for himself."

Who Shall Do It?

The problem of labor and overproduction in some departments is thus sensibly treated in the Philadelphia *Ledger:* Agricultural enthusiasts foretell the time in this country when the tea plant will equal the railway plant in value; and, indeed, there seems to be nothing but time and opportunity needed to demonstrate that the United States can grow all its beverages and its condiments, and produce, with its varied range of soil and climate, all of the staple luxuries as well as the staple necessities of food. It seems likely that the grave problem of overproduction in mechanical industries will be settled in this way and no other. No man can wear seven shirts at once nor warm himself at seven fires, nor run his locomotive on seven rails, but when all the surplus shirt makers and spinners, miners and manufacturers get to work on the soil, on the French system of high cultivation in small plots, when these begin to raise their own coffee and chocolate, oil and wine, raisins, silk and sugar, tea and molasses, in proper localities, as well as their own pork and beans, potatoes and mutton, cheese, wool, corn, hemp, and chickens, they will have at least enough to satisfy the appetites of their families and their need of exchange. Food is the first necessity, then clothes, shelter, and fuel, and the folks who raise their own food are secure that far. It will be a long time before this country sees an overproduction in all kinds of food. There are not enough oranges grown in Florida until they can be sold as cheaply in Minneapolis as they now are in Philadelphia, and when the money that is now sent abroad to buy silks, and coffees, and teas, is distributed among cultivators at home, the Grangers can afford to subsidize and extend the railroads, instead of cutting their throats. The country is like an overgrown boy in some respects of population; the jacket and trowsers of a few years back will not cover its robust proportions, and the old industries that held the population busy, cotton, woolen, iron, and the few staple foods, are showing all their seams strained to the utmost to maintain their laborers. What is needed is not to patch the old jacket, but to put the nation in new clothes that will hold it, with more breadth of cut and amplitude of pattern, and the agricultural industries, in wider range, offer this room to grow and spread in.

In a country less favored than ours, where the range of soil and climate limits the farmer and planter to a few products, emigration has been the one answer of England, and high cultivation that of France; but the United States is limited to neither, although it may find a hint in both. It must be that the overpopulation of some cities and districts must emigrate, not necessarily to far distances, but to such small farms or plantations as will furnish first their food and afterwards their other needs.

It would be a confession of weak intelligence and of little faith for any appreciable number of people in the United States to assume that a dead lock was reached in industrial development solely because the tremendous development of mechanical industries has outgrown and left behind all others and has outstripped the present needs. With the magnificent undeveloped resources of the country, after the inevitable pause of amazement and relaxation that we have passed through, there must be a redistribution and a readjustment. Who is to start on these new roads? Who is to teach the manual skill required, the judgment, the knowledge of soils, of chemistry, of weather, that will be needed to grow the new products? They cannot be picked up in a day, nor can Americans raise tea and coffee, cultivate silk worms, and so on, as they go offhand into a clerkship or a mill. Quite as much as industrial schools to teach boys to make nails and understand looms and manage machinery is it needed to teach the future farmers and planters the practical science and the theoretical also of agriculture. If a certain proportion of the population is to be occupied in this industry, it is wise not to spend time over logarithms or steam engines, but over the chemistry and the art of farming. It is just as well to take a broad look while we are about it, and if there are too many men now at work in the mines and factories and railroads, why set all the boys to learn how to make iron, and to make surveys, and study the mechanical industries and handicrafts? Some of these at least should be learning in the direction of the future, rather than of the overgrown present. But every farmer is the better for learning how to handle tools, and, so far as the industrial training is applied towards manual deftness, it can be the foundation for the farmers too. From the standpoint of the public schools, as well as the labor market, it is wise to consider all these things.

Fig. 7

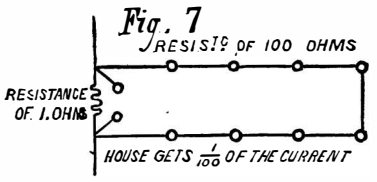


Fig. 8.

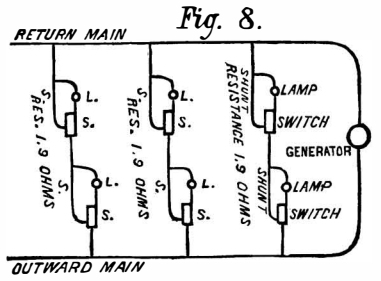


Fig. 7.—DERIVED CIRCUIT. Fig. 8.—BRANCHED CIRCUIT.

New Mechanical Inventions.

Mr. Thomas Dehart, of Meadows of Dan, Va., has patented an improved Water Wheel, which is cheap, compact, and capable of utilizing the water power effectively without liability to stoppage or interruption by obstructions.

Mr. Andrew I. Hogan, of La Clede, Ill., has patented an improved Machine for Cutting Basket Splints. This is an improvement on the machine for which letters patent No. 200,912 were granted to the same inventor March 5, 1878. With this machine the ends of the shingles or box splints or veneers may be cut off squarely at the same time that they are cut from the block, and by the same movement of the gate or knife frame.

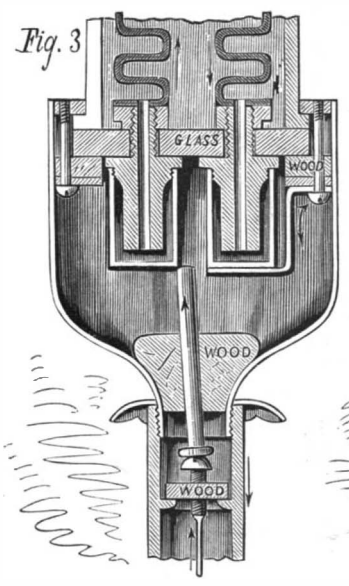
Mr. Horace Woodman, of Saco, Maine, has devised an Improved Shuttle Motion for Looms. This invention relates to that class of looms wherein all of the parts of the loom are driven by mechanism that imparts to them positive motions. In this class of looms it is necessary to have two dwells, one in the movement of the shuttle and one in the movement of the lathe. The dwell in the shuttle movement is, in this case, secured by the relative position and proportion of the cranks and connecting rods employed to throw the shuttle. The working parts of the shuttle shifting mechanism consist simply of the two latch springs and the two inclined planes on the shuttle. In locking and unlocking the shuttle both springs are employed.

An improved Calculating Machine has been patented by Mr. Willgodt Odhner, of St. Petersburg, Russia. This is an instrument for assisting in calculating, it being adapted to add, subtract, multiply, and divide numbers, without any other labor on the part of the operator than that required to set and rotate certain numbered and counting wheels, and to adjust a slide carrying a series of recording wheels. The details of construction of parts cannot be well understood without an engraving.

Mr. William T. Carter, of Village Springs, Ala., has patented an improved Harvester Thrasher, which will thrash the grain while standing in the field. It is simple in construction, convenient, and effective.

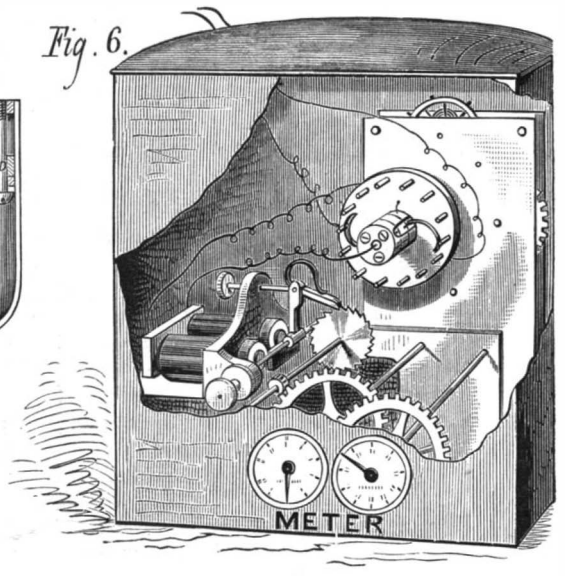
Mr. Aaron Brosius, of Fort Wayne, Ind., has patented an improvement in the class of Vehicles formed of endless oval or elliptical frames or tracks and flexibly connected trucks traveling around the tracks. Vehicles of this class are especially adapted for use in localities where the soil is soft and the roads liable to be muddy or sandy, since the trucks are not caused to move or advance like an ordinary carriage wheel through the stratum of soil, in which they become more or less embedded when supporting the weight of the vehicle, but are successively lifted out of the soil and carried around over the body of the elliptical track as the vehicle advances.

Fig. 3



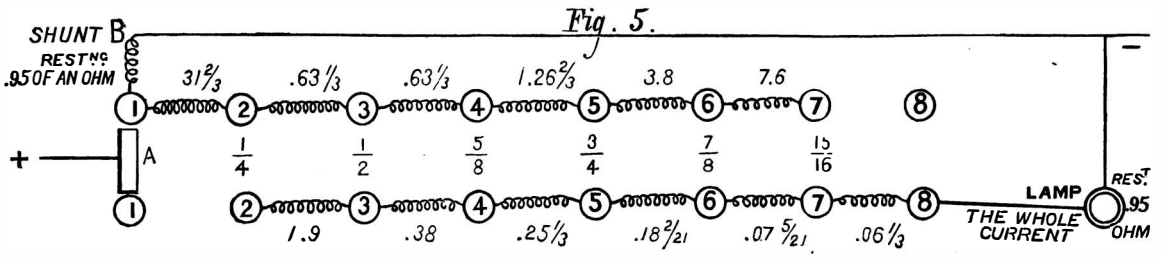
BASE OF SAWYER-MAN LAMP.

Fig. 6.



THE SAWYER-MAN METER.

Fig. 5.



PRINCIPLE OF SWITCH.

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VALVOLINE.

We present herewith an illustration of the display of Leonard & Ellis at the Paris Exhibition. For a number of years this firm have been experimenting in the production of a superior lubricating oil, that should contain none of the deleterious qualities inherent in the animal and vegetable oils that have been in use since the discovery of steam as a motor. After a series of experiments, and a careful study of the laws of lubrication, they finally produced an oil which they call the "Valvoline Cylinder Oil." This new oil was thoroughly examined and tested by the judges of our late Centennial Commission, among whom were such distinguished names as Professor C. F. Chandler, who has had more experience than any man in this country in testing mineral oils, and Rudolph Von Wogner, of Germany, who stands at the head of chemists in the old country. This commission, in their published report, commended the valvoline cylinder oil for its "purity, high fire test, and excellent lubricating body." Certainly nothing more favorable could be said of any oil. The commendation, coming from such a source, is the highest indorsement.

Valvoline is a hydrocarbon or mineral oil. For its production a heavy natural lubricating oil is taken, and all light and objectionable oils expelled by high steam heat; it is then thoroughly filtered through animal charcoal, cloth, and paper, by which means all bitumen and earthy matter are removed, leaving a clear, pure oil of the highest lubricating quality. The destructive acids which are common to animal and vegetable oils are unknown to valvoline. It is a well ascertained fact that the action of high pressure steam liberates the margaric, stearic, oleic, and other acids inherent in all animal and vegetable fats, and these acids attack the joints, valves, cylinder heads, bolts, and other parts of machinery lubricated, oxidizing the metal and feeding the element of destruction in it rather than simply subserving the useful purposes of lubrication. Mineral oils do not contain fatty acids; they are not capable of being decomposed, and do not form insoluble soaps. Valvoline being a mineral oil, purified and refined according to the most approved processes, and capable of standing a high temperature, is probably the best lubricator now in use. It does not oxidize or corrode the metal, but it is said to case-harden it. Its influence on boiler incrustations is most salutary in diminishing their clinging tendency. It will not saponify, and acts as a preventive in foaming boilers.

The importance of this subject of lubricators cannot be overestimated. In the late reports of the British Government, they strongly recommend the disuse of animal and vegetable oils. The Manufacturers' Mutual Insurance Company has gone into elaborate detail in the matter of lubricating oils. The company has been making experiments for the benefit of manufacturers, and has adopted mineral oils. Manufacturers and engineers throughout the country, who are desirous of correct and trustworthy information on this subject, may address Messrs. Leonard & Ellis, 93 West street, New York city.

PARIS EXHIBITION.—LEONARD & ELLIS' EXHIBIT OF VALVOLINE.

American Microscopes.

Professor J. Gibbons Hunt, M.D., of Philadelphia, in a recent lecture, stated that, in his opinion (and he is one of the most experienced microscopists in this country), England, which first introduced cheap instruments, sits at the feet of America in respect to both lenses and mechanical appliances. He says it is affectation or stupidity for Americans to send to Europe for microscopes when they can purchase better ones at home.—*Medical and Surgical Reporter.*

The Shrimp Fishery in San Francisco Bay.

The Chinese of California have developed a large and, to them, profitable industry along the shores of San Francisco Bay, in the capture and curing of the shrimp, with which those waters swarm. Over five hundred Chinamen are engaged in this work, distributed mainly along the southern portion of the bay, in camps of from twelve to forty men each. According to the San Francisco *Bulletin*, the business at first hands now amounts to $15,000 a month, and new markets are constantly opening. At certain periods the demand is so great that two trips into the bay are made daily, which nearly doubles the amount of ordinary supply, and necessitates the employment of a large force of extra men. The most serious disadvantage of the trade is that it can at present be prosecuted only during the dry season, the rain preventing the exposure of the shrimps for drying purposes. This difficulty will probably be obviated as the business enlarges, by the drying and crushing of the shrimps in heated rooms, instead of the open air, during the winter. To avoid infringing the very stringent fishery laws of California, the nets are sunk from twelve to twenty fathoms, or below the level usually traversed by the fish of the bay. The nets used are funnel-shaped, and about 36 feet in length. The diameter at the mouth is 18 feet, but decreases by gradations to one foot at the lower extremity. The mesh is usually a half inch on the square for a distance of 30 feet from the orifice, but is less than a quarter of an inch in width from that point to the smaller end. The time chosen for setting the nets is when the tide is coming in, and they are allowed to remain in the water until after the ebb. They are then lifted and the contents conveyed to land. The camps described possess 36 boats, and five men constitute a crew. Each boat contains from 12 to 15 nets, and 20 baskets of shrimps at a single catch is a fair average. These baskets will hold about 150 lbs. each.

After landing, the shrimps are placed in vats of boiling water, with a fire underneath, and boiled for about half an hour, being frequently sprinkled with coarse salt. They are then spread out on hard, dry ground, and left to dry and bleach for three or four days, being frequently turned. At the expiration of this time the shells, spawn, and dirt are either detached or in such a dry and cracked condition as to be easily removed. A force of Chinamen is then put to work tramping the beds of dry shrimps with heavy wooden shoes. The trampers go over and over the mass, sliding their feet as does a negro dancer when he is shuffling over the stage. The tramping process concluded, the miscellaneous mixture is put into a winnowing machine, where the shells are separated from the meat as perfectly as chaff is from grain. There are three spouts to the separator, through one of which the whole shrimps are shot into a basket. The other spouts are used respectively for the shrimps crushed by the tramping and the detached hulls. Thus dried and skinned the shrimps are put in bags and sent to the city. A few of them are shipped to China, but owing to the high rate of transportation, which makes the article more of a luxury than a commodity in that country, the export trade has not proved profitable. The first price of dried shrimps in San Francisco is from 5 to 8 cents per pound. A sack containing 150 lbs. of the undried article will produce from 8 to 10 lbs. after the drying process. Before curing, the spot price of shrimps is from 2 to 3½ cents per pound. Delivered to restaurants the price is 5 cents per pound. The principal camps of Chinamen are in the interior towns, where the shrimps command a high figure, and when made into soup are esteemed a dainty dish.

The broken shrimps, whose segregation has been alluded to, are ground into a coarse flour, which retails at from 3 to 4 cents per pound. A use has also been discovered for the shells, and they are shipped exclusively to China. There they are valuable as manure, and as a poison to the worm which works such destruction to the tea plant of that country. There is nearly as much profit from the sale of the crushed shells as from that of the shrimps themselves. The Chinamen state that this is the only remedy at present known for the tea pest, and the heavy shipments indicate that this article has more virtue than other fertilizers.

A GROOVELESS tramway was recently inspected in Birmingham, England. Mr. C. A. Edge, the inventor, had laid a quarter of a mile of line in the shape of a figure 8, with several gradients, and he ran cars upon it throughout the most of the day. The rail is a flat plate, regularly pierced with holes, and protuberances on the wheels fit into the holes. The object is to get rid of the inconvenient grooves of the tram systems now in general use.

Disabilities of British Workmen.

Mr. Graham Bell's account of the difficulty he experienced in getting any novel idea put into material form by British workmen has called out the following statement by Thomas Fletcher, in the *English Mechanic:*

"The letter of Mr. Graham Bell, I think, only gives the really true state of things. After twenty years' experience in experimental work in England I can only say that the experience of Mr. Bell is precisely the same as my own. The British workman, having, as a rule, no general training or knowledge worth the name, seems almost unable to get out of a groove in which his ancestors ran. For the last ten years, in anything requiring judgment on the part of the workman, I have found it far less trouble to make the thing with my own hands than to give a workman instructions, which in many cases he will not follow because he does not understand, nor does he care to learn the reason why of anything. Many tools in common use have serious faults, and are not properly adapted for their work.

"When I have applied to the makers, showing them the faults, and asking for modifications, irrespective of price, I am met on all sides by a refusal to entertain the idea, the invariable reason being that the workmen will not go out of their regular groove. I have in many cases sent rough sketches of modified tools to America which I have totally failed to get made in England at any price, and have afterward been able to buy the very things, of American manufacture, in English tool shops. I know of cases where English tool makers have been obliged to buy American made tools to do their work, tools which English workmen would or could not copy.

"'The proof of the pudding is in the eating.' I have at this moment at least three fourths of my tools of American manufacture, many of which have been bought at a very fancy price. If it were not an absolute necessity I should be exceedingly foolish to buy American tools at a high price if English tools were to be bought which would do the work equally well. From my own practical experience the difference between the two is, that an English workman does not, in the first instance, learn what a tool is for, and adapt the tool to the requirements; an American workman will, as a rule, use his brains and make what you want without spoiling the whole by ridiculous blunders.

"The Americans are fully capable of making rubbish, but they are not alone in this point; many English things are simply made to sell; but certainly, if I needed a thing, making which required judgment on the part of the workman, and I could not give personal and constant supervision, I should, as the simplest way to get the thing right, send the instructions to America.

"The English employer is, as a rule, a man of sound knowledge, and fully capable of undertaking anything in his own department, except in the matter of getting his workmen to do what he requires with judgment; the man is a machine, not expecting to have to use his brains, and the few workmen who do use their brains are so very rare and valuable that the effect on the mass of workmen and work is exceedingly small, gradually becoming *nil*, as these men usually become masters, and in their turn have to exert their energies, not to work, but on the British workman.

"The first thing to be done is to give apprentices not the present rule of thumb education, but start them with a training purely technical, and combine this with practical work; one is of little use without the other."

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CAR PAINTING.*

BY MR. D. D. ROBERTSON, MASTER CAR PAINTER OF THE MICHIGAN CENTRAL RAILROAD.

Some of the grandest inventions and achievements have been the result of accident; and in the regular routine of mechanical or professional business, successful results have at times been attained in the absence of any practical or scientific reason therefor. Some professions are of such a nature that there is no difficulty in making certain and definite calculations as to the final issue of a piece of work, while with others everything is so dependent upon circumstances as to make it quite impossible to determine the end from the beginning. There are few pursuits more dependent in this way than that with which we are connected.

To be a successful car painter, requires the closest attention, the most thorough application, and the most constant watching, and even then "deviltries" will appear which baffle the skill, experience, and patience of the most practical and amiable of the craft. Many, however, of the vexations and annoyances of the paint shop have been overcome, and a large amount of the heartrendings, crackings, flakings, and pittings are found to be due more frequently to want of knowledge, attention, and care, than to inferior material. While we admit the bad results caused by the use of such material, sudden changes in the weather, etc., there are at the same time defects and imperfections to be seen on our cars that can only be designated as careless blunders. An interchange of views formed by careful observation has done much, and will do more, to improve the character of our work. Allow me then to give as briefly as possible the method I at present pursue, not with the idea of presenting anything new or startling, but to draw from others any experience that may differ from my own.

NECESSITY OF A GOOD FOUNDATION.

In painting, as in most other things, a good foundation is absolutely necessary, and to secure this everything depends upon the quality and mixing of the material, and also upon the handling of it. The priming of a car is regarded by some painters as a simple matter, and as a matter of economy this preliminary work is often placed in the hands of inexperienced or low-priced workmen. This is a false step at the start, and when once taken we have to hobble through the whole job. In every part of the work there is a definite object to be accomplished. The object in priming is to fill the pores of the wood. It must be cohesive and have a proper elasticity. The thinners used should enter the pores without congealing on the surface, thus insuring permanency.

THE PRIMING.

For priming, I use keg lead mixed with the best raw linseed oil. To a pint of oil I add a tablespoonful of Japan size. In mixing, care should be taken not to have it too thick, and to be sparing in the use of Japan, the excessive use of which tends to lessen elasticity as well as durability. Some painters use boiled oil in priming to avoid the greasy character of raw oil, but my objection to the former is that it is less penetrating, and that it tends to congeal on the surface. The best method of preparing raw oil for priming that I have ever used, is as follows: Take 1 gallon of oil, put ½ lb. litharge into it, place near the stove, and shake three or four times a day for a few days, and then let it settle and run off. This improves its drying properties and frees it from grease. No gold size is used with it. Before applying, all nail holes, crevices and beads should be properly filled, and then it should be laid on regularly and evenly, leaving no fat edges.

After the work has stood from four to six days, or longer if possible, it is then ready for the second coat, which is the same as the priming, only a little heavier. The same care should be taken to lay it on evenly and fill all crevices and holes. I prefer puttying after the second coat is on, as the holes are more likely to be filled, which is necessary for the putty to adhere; a less body of putty is also required, and therefore is less likely to swell, which is a source of trouble very often when the work is nearly completed. As a precaution against this, some painters have the holes soaked with warm water before the cars leave the erecting shop.

THE PUTTY.

The hard putty I use is composed of dry white lead and whiting in equal parts, mixed with Japan gold size and a very small quantity of raw oil or a little keg lead. I have found the whiting makes the putty less liable to swell; and let me say here that very frequently the painter is blamed for this, when the actual cause is the shrinkage of the wood. The hole or crack should be completely filled, and the putty may even project a little so that it may be rubbed down to the exact level. Very close attention must be given to this part of the work, so that little or no puttying may be required after the rough stuff has been surfaced.

The putty now being leveled down and the whole body sand-papered, the car is ready for the third coat. This is made with tub lead reduced with "turps,"† and a small quantity of Japan gold size laid on with the usual care. In order to secure a good job these priming coats must be perfectly dry. After three days the rough stuff may be put on.

THE ROUGH STUFF.

There is no end of receipts for rough stuff, but the kind I have used with great satisfaction for some time is composed of 8 lbs. mineral, 3 lbs. dry white lead, 1 lb. tub lead, 2 parts gold size, 1 part rubbing varnish, and thin with turps. The laying on of this preparation is frequently deemed unworthy of the care usually bestowed on painting. But this is a mistake, as all the principles as respects the laying on of paint should be strictly followed in the laying on of rough stuff. A large amount of time is saved by not applying it to the battens, and by leaving about ¾ of an inch diagonally at the corners of the panels. One coat is sufficient except on hard wood, which should have at least two coats. When such wood is very open grained, I prefer knifing it before rough stuffing, using tub lead with a very little turps and Japan. For rubbing rough stuff, I have used different kinds of stone, but have settled down on picked pumice, which is cheaper, and at least as good as any other.

At this stage of the work the car body should be carefully examined, and if any imperfections are found, now is the time to fix them. After thoroughly sand-papering, the work is ready for coloring.

COLORING.

The color on the Michigan Central Railroad cars consists of golden ocher ground heavy in oil along with medium chrome ground in turps and Japan, and brought to the proper consistency with turps. To finish a car properly with this color, four coats are required, and from first to last there cannot be too much care taken in laying it on in order to secure a solid job and lose nothing of what has preceded. The color should be worked quickly, put on sparingly, brushed out well and laid off evenly. I would recommend a flat sable brush as the best and most economical for laying color.

Very often the labor expended in bringing a car up to the point of coloring is completely lost by the mixing of the color, or by the manner in which it is laid. I make no change in the formula of these coats, and do not use any varnish in last coat. The work should be sand-papered and carefully dusted off after each coat, and one day's time at least should intervene between the coats.

VARNISHING.

The car is now ready for varnishing. For the first coat I use an outside rubbing varnish, which can be rubbed down very close in four days and washed clean. This forms a beautiful surface for striping and ornamenting. The men who do the striping should be so arranged that each may work on his specialty, as this secures better work by exciting a greater desire to excel.

STRIPING AND GILDING.

Striping colors are ground heavy in boiled oil with a little Japan gold size and thinned with turps. Furnish each man with a gauge, divide the car into sections, and let each finish his allotted portion. Emulation is thus excited, and each man is responsible only for his own proper work, with no risk of blame that is undeserved. For gilding, I find that a quick size is the best. I use Noble & Hoare's gold size with about one third their wearing body varnish.

FINISHING.

The car is now ready for the finishing coats of varnish. First of all it has to be carefully washed down with cold water to clean off any soiling that may have got on during the striping and ornamenting. The cleaning must be done with brush, sponge, and chamois, and so thoroughly as to remove the smallest particles from mouldings, etc., as the varnish brush is sure to find them and bring them to the surface. In my experience there are comparatively few, even of good workmen, who can varnish a car properly. Some are so afraid of sagging that they put the varnish on sparingly, while others, with the greatest ease and safety, will put a third more on the body without the least tendency to sag—and then again the work of some is much more even and regularly flown than that of others using the same material and on the same body. On the finishing coats as much varnish should be put as they will safely carry. For some time I have abandoned rubbing between the coats. As a matter of beauty, I would prefer a slight rubbing of the first coat, but I willingly sacrifice this advantage to secure what is of more importance, namely, economy and durability. Instead of rubbing before the last coat of varnish is applied, the previous coat must be thoroughly hard and washed down with cold water. Then by using every precaution to get rid of dust, and with care and proper handling, the last coat should stand out, and the entire job reflect credit on the painter and also on the venders of the materials used in the work.

* Read before the recent meeting of Car Painters, at Cleveland, Ohio.

† Painters' term for turpentine.

A New Coloring Matter.

The well known firm of dye manufacturers, Meister, Lucius & Brüning, of Höchst, have brought out a series of colors for the production of ponceau in yellower and redder shades, and also of claret upon woolens. These coloring matters are produced from the sulpho-naphthylates by treatment with the diazo compounds of benzol and its homologues, as well as of naphthalin. These colors can be used for dyeing with the mere addition of sulphuric acid, but the shades are not so bright as when a solution of tin is employed. To 100 kilos of wool, placed in a wooden or well tinned dye bath, are added 2½ kilos tartar, and boiled. The color, previously dissolved, is added as may be required, and 5 kilos of tin composition are gradually added. The wool is then taken out, cooled, and washed. The tin composition is made by mixing 3 parts hydrochloric acid, 1 part nitric acid, and one part water, and dissolving ½ kilo tin in 3 kilos of this acid liquid.

Nickel Pyrites.

At Krageröe, Norway, magnetic pyrites, holding on an average 1·25 per cent of nickel, is worked by the following process, which Friedr. Bode describes in *Dingler's Polytechnic Journal:* The raw ore is smelted with slag from refining in a 13 foot 3 tuyere shaft furnace, the slag made being thrown over the dump, while the raw matte, holding 3·5 per cent of nickel, is roasted in stalls. This roasted matte is smelted in a low furnace with one tuyere, 4 feet high. The slag, holding 1 to 1·5 per cent of cobalt, goes to the ore smelting. The matte contains 30 per cent of nickel and 15 per cent of copper, and is returned to the same furnace, which concentrates it to 60 per cent of nickel and 30 per cent of copper. The sulphur is only 10 per cent. This matte is ground and roasted completely in a small reverberatory furnace, and the oxides are reduced with charcoal powder in graphite crucibles, yielding 68 per cent of nickel and 30 per cent of copper. By the addition of copper this product is smelted into an alloy of one of copper and one of nickel, which is marketable.

The Boot and Shoe Industry.

The returns of one of the patentees who collect a royalty on every boot or shoe manufactured by machinery show that the greatest number of pairs ever turned out in one month were manufactured in September, 1878—four million one hundred and ninety-one thousand seven hundred and seventy-six pairs. For the year, however, the manufacture up to October 1 was only twenty-three million one hundred and ninety-seven thousand pairs, against twenty-five million two hundred and eighty-five thousand for the same time last year, or a reduction of about eight per cent. The total shipments from the Boston market up to date have been one million two hundred and ninety-five thousand one hundred and forty-six cases this year, against one million four thousand nine hundred and twenty-one cases for the same period last year. This falling off is due in some measure to the increased employment of shoemakers to work by hand in the old-fashioned way. There probably has never been a time when a day's work will go as far in buying boots and shoes as to-day.

Unwarranted Alarm.

A correspondent predicts volcanic disaster to follow the boring for mineral oil and the utilizing of natural gas wells, in Pennsylvania and Ohio. His opinion is that the oil and gas are the forerunners of volcanic fires, which will be brought to the surface by the "ventilation" incident to well sinking. Deep mining is another source of peril, he thinks. His anxiety arises apparently from a mistaken theory of the nature of volcanic heat and activity—namely, that it is due to combustion. Recent investigations make it altogether more probable that those phenomena are due to pressure in and the fracture of the earth's comparatively rigid exterior, in consequence of the cooling and shrinkage of its nucleus. Such being the case the predicted peril is quite imaginary.

Raft Decked River Steamers.

The Princess Alice disaster has elicited from Mr. R. F. Fairlie a suggestion that river steamers should be so built that the deck should be complete in itself, and capable of floating like a raft, even with a considerable weight of passengers, and that it should be secured to the hull by a fastening of a temporary character, which could readily be withdrawn in time of danger, leaving the hull free to sink alone, while the deck would be left upon the surface. Explaining how he would accomplish his ends, he says a simple way of fastening the deck to the hull would be by eyes descending from the under surface of the deck, and passing through slots in angle irons, which should form part of the sides and of the upper surface of the hull. Each of these eyes should receive a 1½ inch pin, and all the pins should be connected to a chain, or to levers worked by a chain, which should itself be carried to a wheel placed immediately astern of the steering wheel. It would then be easy for the steersman, on an alarm being given, to withdraw the whole of the pins by a single movement.

Spontaneous Combustion.

Dr. Hoffman has called attention to some curious cases of spontaneous ignition of hydrogen in air. The phenomenon has been noticed in factories where large quantities of zinc were being dissolved in hydrochloric acid for the preparation of zinc chloride. Violent explosions took place when no flame was near; and it was eventually ascertained that the gas took fire spontaneously. It appears to be caused by fragments of very porous zinc, which, when lifted above the surface of the liquid during the violent evolution of the gas, and so brought in contact with hydrogen and air, act just as spongy platinum would do under the circumstances. The author recommends the performance of such operations in the open air. The ignition can be shown by treating a few kilogrammes of finely divided zinc with acid. The "zinc dust" may even ignite by contact with water.

PROFESSOR S. P. LANGELY, Director of the Allegheny Observatory, in addition to the routine work connected with the institution over which he presides, has lately been busily engaged in completing a direct experimental comparison between the heat of the sun and the highest heat attainable in the arts. The result of his investigations indicate that the sun's *intrinsic* heat is almost beyond comparison greater than that of any blast furnace, and far larger than has been reckoned by the French physicists.

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NEW TRUNNION AND TRIMMER.

This improved trunnion is designed for oscillating engines, drying calenders, car axles, fly wheel shafts, crank pins, etc., and is of great utility wherever there is a bearing subjected to great friction and wear.

It is a well known fact that while car axles frequently heat and cut, it seldom happens that the journals of a locomotive driver shaft become heated, although they are subjected to greater pressure; and a driving shaft under a locomotive, it is stated, will run for fifteen or twenty years, whereas a car axle will run for about two years only. To lessen friction and increase the durability of car axle and other bearings, Mr. Thomas Hill, of Newark, Alameda county, California, has perfected and patented the improved trunnion and trimmer shown in the accompanying engravings. Fig. 1 shows the driver as applied to a steam trunnion or tubular shaft. Fig. 2 shows the application of the device to car axles.

The trunnion is made of two parts. The inner part, through which the steam passes, is made with four or more projections, B, with corresponding spaces or depressions, C, between them, so that a transverse section represents a cross. These projections, B, are turned off in a lathe, and a sleeve, A, is fitted to slide on over them. This sleeve is made fast to the arms with a set screw or pin, one inch from the end, and is turned smooth on the outside to form a journal. A hole is made through this trunnion for the passage of steam, which is brought to it through the pipe, A. This pipe enters the hole in the trunnion, and is packed so as to be steam tight. Whenever the sleeve, A, becomes worn, it can be removed, and a new one substituted with but little delay; the cylinders, with the ordinary trunnions, would have to come out. The spaces formed by the depressions, C, in the inner part, allow a free circulation of air about the trunnion, either naturally or by blast, so that the journal is kept cool and will work better. A trunnion thus constructed can be introduced advantageously for oscillating engines, drying calenders, or in any place where it is necessary to have a joint through a movable bearing or journal.

The trunnion and trimmer may be applied to car axles or shafting with great advantage whether they are old or new; when applied to shafting it may answer both as a coupling and a journal; it is also especially adapted to thrust bearings. As the wear comes wholly upon the sleeve the expense of renewing a shaft or axle is avoided, and the sleeves can at any time be replaced, at a slight expense, in a few minutes, when the old one becomes worn out. When applied to a car axle or shaft the chambers, C, by acting as receptacles for oil, assist in lubrication, as the oil is received and discharged at every revolution through the holes.

For further particulars address the inventor, at Newark, Cal., as above, or at 64 First street, San Francisco, Cal.

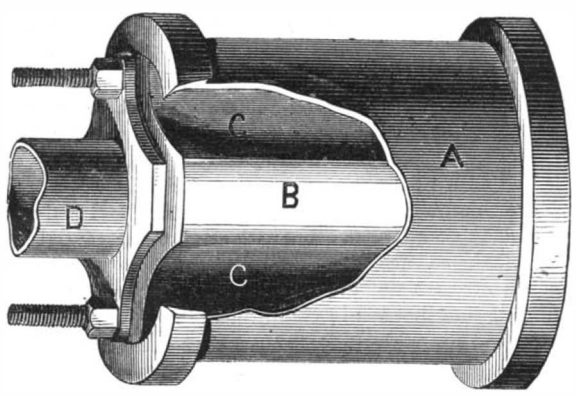


Fig. 1.

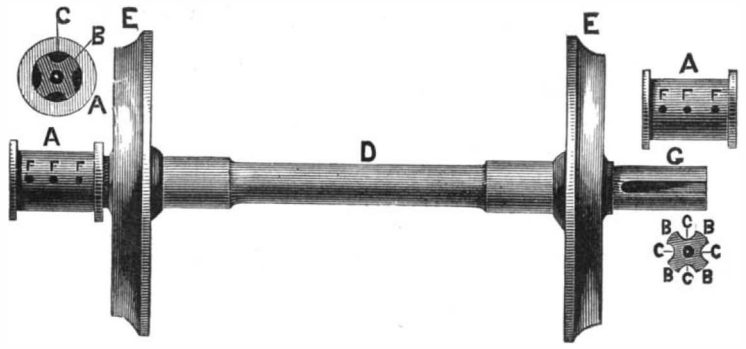
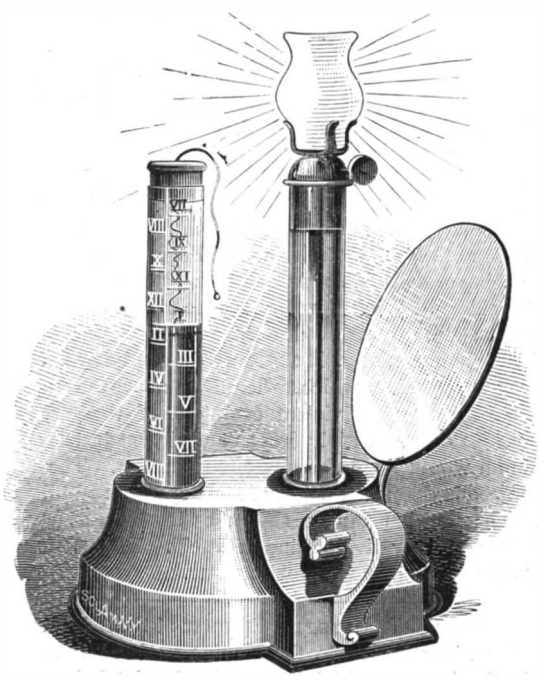


Fig. 2.

HILL'S TRUNNION AND TRIMMER.

NEW TIME-INDICATING NIGHT LAMP.

The accompanying engraving represents an ingenious and very simple time-indicating lamp, recently patented by Mr. Henry Behn, Sr., of this city.



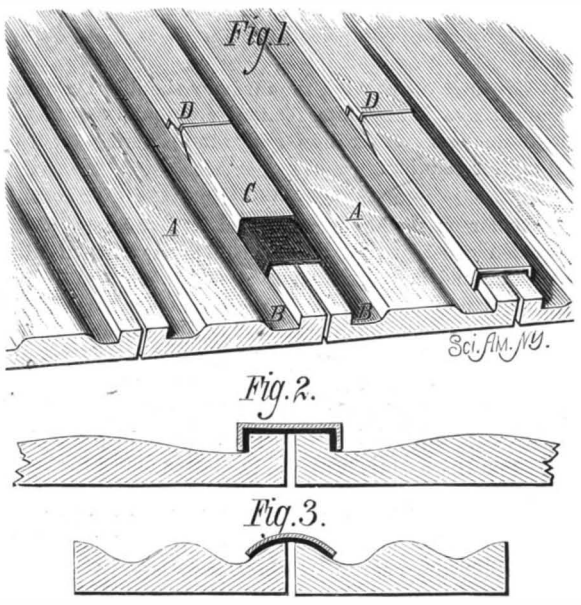
TIME-INDICATING NIGHT LAMP.

The invention consists in a reservoir for containing oil, and two vertical glass tubes rising therefrom. The lamp burner is placed on the top of one of these tubes, and the other contains a float, and has the hours marked on it. Near the foot of the tube which supports the burner there is a reflector, which receives light from the burner and throws it upon the graduated tube.

As a certain quantity of oil will be burned each hour, the sinking of the oil will indicate approximately the time. The inventor, in some cases, dispenses with the float and uses colored oil.

AN IMPROVED ROOFING.

The accompanying engraving shows in perspective and in section a new roofing recently patented by Mr. Nathan H. Brown, of Detroit, Mich. This invention consists in the peculiar form of roofing boards and metallic batten strips which cover the joints between the roofing boards, and in a novel method of connecting the ends of the metallic batten strips.



BROWN'S ROOFING.

The boards, A, have, near their adjacent edges, grooves, B, for receiving the edges of the metallic batten strips, C, the form of which may be seen in Fig. 2. Between the metal batten and the boards there is a strip of tarred paper or roofing felt which renders the joint water and air tight. The batten strip is made in sections, one end of each having its flanges beveled, while the other end is cut and turned down, forming locks for receiving the beveled flanges of the succeeding strip, as shown at D in Fig. 1. A modified form of board and batten is shown in Fig. 3. The boards should have a coat of paint before applying the battens, and it should afterward be covered with two coats of fire and water proof paint. The nails which secure the boards are covered by the battens.

The inventor states that the roofing boards may be readily made by means of an ordinary moulding or planing machine, and says that the roof made on this plan will not be more expensive than a shingle roof, while it has many points in its favor.

For further particulars address the inventor as above.

Persistence of Images on the Retina.

It will be remembered that about the beginning of last year Dr. Boll threw some new light on the structure of the retina by the discovery of a substance of purple color in the last retinal layer, in which a portion of the "rods" is engaged. It had escaped notice before, because of its very rapid disappearance on the action of light. Dr. Boll felt himself warranted in saying that the formation of images on the retina was a veritable photography. Subsequently Dr. Kühne discovered the organ by which this purple is incessantly reproduced, namely, the mosaic layer, or thexagonal epithelium of the choroid, which, therefore, it has been proposed to call the retinal epithelium. M. Giraud Teulon, in a recent report, calls attention to some modifications in theory required by the unlooked for physiological function referred to. Thus as regards the persistence of positive images (that is, the continuance of the sensation after the impression that produced it), the simple fact of chemical decoloration of the retinal purple by the light, involving a certain time for its reconstitution, by the secreting action of the mosaic layer, gives a sufficient account of the phenomenon. Then, as to accidental negative images and their successive phases of coloration, the photo-chemical theory replaces Young's perfectly arbitrary explanation, based on three supposed different kinds of fibers, by a simpler one, which is this: A given monochromatic light chemically alters, in a constant and uniform way, the retinal purple which it encounters. Now, the rod, or primitive nerve element, has its base immersed in the bath formed of this substance.

We have only, then, to suppose in this element the power of feeling in a different way, the intimate contact of different media, exactly as the *papillæ* of the nerves of special sensibility (like those of smell and taste, for example) appreciate or carry to the sensorium stimulations as varied as is the nature of the liquids or effluvia which come to them. When the primary cause, the luminous object, is withdrawn, the nerve fiber, according to the progress of the reconstitution of the purple, announces by successive testimonies the gradual renewal of the normal bath.—*London Times.*

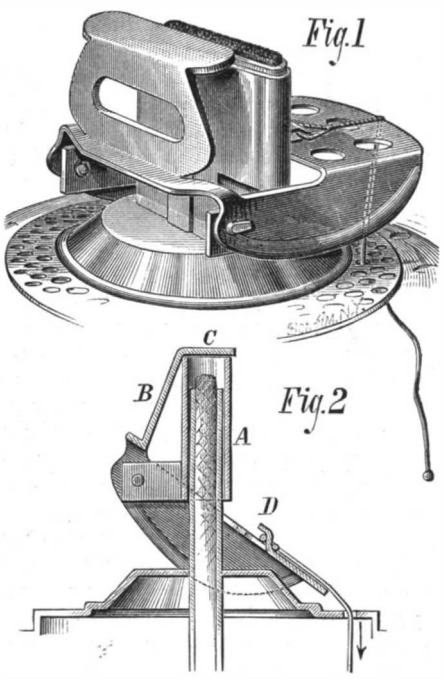
The Secrets of a Bushel Measure.

The *Pharmaceutical Journal* gives some curious information respecting the variable results obtainable in the measurement of dry goods. The Weights and Measures Act of England, passed last session, expressly prohibits "heaped measures," and requires that the measure shall be filled as nearly level as the size and shape of the articles will permit. This led to some experiments as to the results following different modes of "striking" a measure, that is, of bringing the level of the contents of the measure into the same horizontal plane as the brim.

A sample of corn was taken, and the true weight of a standard bushel of it was ascertained to be 57 lbs. 2 ozs. But when the ordinary flat strike is used the corn left in the measure weighs 57 lbs. 3 ozs., while, if the ordinary round strike or roller be employed, the quantity of corn is increased to 57 lbs. 9 ozs. If the measure be shaken when struck with a round ruler the weight rises to 62 lbs. 15 ozs. The diameter of a vessel, in proportion to its depth, appears to make little difference in measuring grain, unless the diameter is less than one third of the depth. The Board of Trade standard dry measures—the bushel, half bushel and peck—have their diameters nearly double their depth, while those for liquids have their diameters nearly equal to their depths. But it is found that, particularly in the sale of such articles as coke, potatoes, etc., the proportions adopted in the standards for dry goods are those most likely to give just results.

A NEW LAMP EXTINGUISHER.

The accompanying engraving represents a novel and simple lamp extinguisher recently patented by Mr. Albert Hall of this city. It may be made and sold separately from the burner, and may be readily applied by the purchaser to lamps already in use. To the slide tube, A, which fits over the wick tube of the burner, is pivoted a lever frame, B, which carries the cap or cut off, C. The lever frame, B, has cams formed on it which bear upon the bottom plate of the burner. A cord is attached to the lever frame, at D, and extends downward through one of the perforations of



HALL'S LAMP EXTINGUISHER.

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the bottom plate of the burner. When this cord is pulled the sliding tube, A, is raised, and the cap, C, swings over it, instantly extinguishing the flame.

The device is readily removed from the lamp burner for cleaning, and is easily replaced, being complete in itself and not attached to the burner.

For hanging and other lamps placed too high to be easily reached, this invention is valuable, as it only requires a pull of the cord to extinguish the light. Further particulars may be obtained by addressing the inventor, P. O. Box 2326, New York city.

A Marble Boring Sponge.

In 1871, a vessel laden with a cargo of Carrara marble was wrecked off the south coast of Long Island. This year some of the marble having been raised was found to be perfectly honeycombed by some marine boring animal. A fragment of the marble was exhibited at a recent meeting of the New York Academy of Sciences, and the opinion expressed by one of the members that the work of destruction was probably due to a species of *Pholas*. Dr. Newberry, however, was inclined to believe that it was due rather to the ravages of a species of sponge of the genus *Cliona*, and this view has been recently indorsed in a note on the subject published by Professor A. E. Verrill, who has had an opportunity of examining some specimens sent to the Peabody Museum of Yale College. Professor Verrill states that the exposed portions of the slabs examined by him are thoroughly penetrated to the depth of one or two inches by the crooked and irregular borings or galleries of the sponge, *Cliona sulphurea*, so as to reduce them to a complete honeycomb, readily crumbling in the fingers. The marble is perfectly sound and unaltered beyond the borings. He says that the rapid destruction of the shells of oysters, etc., by the borings of this sponge has long been familiar to him, but he has never before seen examples of its effects on marble or limestone; for calcareous rocks do not occur along those portions of our coast inhabited by the animal. He suggests that its ability to rapidly destroy such rocks might have a practical bearing in case of submarine structures of limestone or other similar materials.

PARIS EXHIBITION.—FACADE OF AUSTRIA AND HUNGARY.

The façade of Austria and Hungary is simple in appearance, but it lacks neither grandeur nor elegance. Its architect had in view not only the Austrian and Hungarian architecture, but also the vestibule of a palace of fine arts. In reality these two pavilions are devoted to art; the one on the south includes the bureau of the Austrian Commission, the one on the north the bureau of the Hungarian Commission. These buildings are of cut stone, and each has above and below three windows. They are very plain on the first and second floors, and appear to have no roofs, but are crowned with a balustrade of stone.

The colonnade that unites the two pavilions forms a portico of nine arches, the abutments of which are each supported by an entablature, supported by two columns of white stone.

The ornamentation of this building consists of festoons and allegorical figures painted in black upon a white ground; the attic that crowns the frieze is equally ornamental.

Above the portico there are statues of art, science, history, etc. At one end of the colonnade floats the flag of Austria; at the opposite extremity the staff bears the flag of Hungary. Within the Austro-Hungarian vestibule were displayed several statues, among which are Michael Angelo, Beethoven, and Albert Dürer, and beyond there were plans of existing monuments and important buildings in Austria and Hungary.

THE COMMON JACANA.

This bird is a native of Southern America, and there are other species scattered over Africa, Asia, and Australia. Mr. Gould tells us that the Australian species is a good

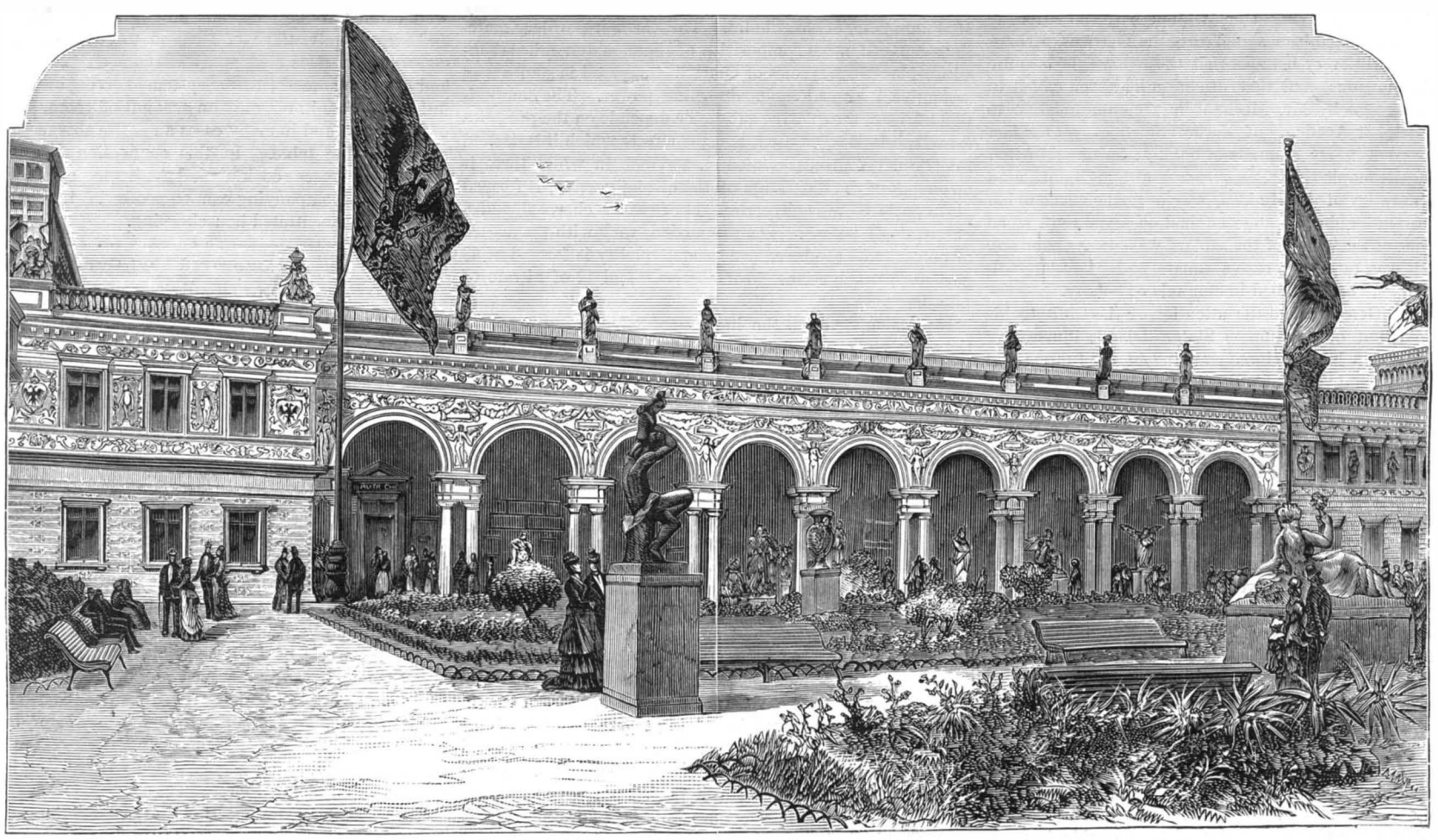
JACANA.

diver, but a bad flier. "Their powers of diving and remaining under water are equal to those of any bird I have ever met with; on the other hand, the powers of flight are very weak. They will, however, mount up fifteen or twenty yards and fly from one end of the lake to the other, a distance of half or three quarters of a mile; but generally they merely rise above the surface of the water and fly off for about a hundred yards. During flight their long legs are thrown out horizontally to their full length. While feeding they utter a slowly repeated 'cluck, cluck.' The stomach is extremely muscular, and the food consists of aquatic insects and some kind of vegetable matter."

The general color of the common jacana is black, with a slight greenish gloss, taking a rusty red tinting on the back of the wing coverts. The primary quill feathers of the wing are green, and the wings are furnished at the bend with long sharp claws. In the African species these spurs are hardly perceptible. At the base of the beak is a curious leathery appendage, rising upon the forehead above and depending toward the chin below. The claws are all very long, especially that of the hind toe, which is nearly straight and longer than the toe from which it proceeds. We take our engraving from Wood's "Natural History."

Natural History.—The Cope Collection.

When E. D. Cope, the Philadelphia naturalist, bought the Argentine Confederation's collection of fossil bones at the Paris Exhibition, he bore away a prize in the face of a powerful competition. Russia wanted them, or the best part of them; a Vienna scientific institution wanted them; Belgium wanted them, and Paris herself had set her heart on them, intending to place them in the Jardin des Plantes. In the face of all opposition, says the Philadelphia *Times*, a Philadelphian secured the lot, and careful hands have securely packed them in boxes preparatory to sending them to America, where they are expected some time this month. These fossils are peculiarly valuable to this country for the reason that the chief portion of them are not be found anywhere in the United States, and there are some specimens the like of which no country in Europe can show. They are a sort of connecting link to collections which America already has. The locality from which they come, Patagonia, is regarded as entitled to rank first in the chain or series of specimens which has been dug up in Ecuador, in the valley of Mexico and in the Western and Middle States. In Phœnixville, several years ago, fossil remains were found similar to those discovered in the Western States, Mexico, and South America. These specimens coming from Patagonia, the southern extremity of the western hemisphere, and bearing such a resemblance to those found in North America, have a value which naturalists, knowing and understanding the relations which one collection bears to another, alone can fully appreciate. The collection includes about one hundred different specimens of animals. The perfect state in which some of the remains are preserved gives them an increased value. There are nineteen skeletons, chiefly of large animals, almost completely whole. The species most numerously represented in the collection are the armadillo and sloth. Among the armadillos there are several kinds of skeletons, pronounced by Mr. Cope entirely new to science. One of these is an immense specimen with a curious sort of tail. It increases in size toward the end, at which point it takes an oval shape and is from a foot to 18 inches wide. Unlike that of all other known kinds of armadillo, the tail is without joints—except one at the base, which enabled it to be swung about—and is incased in a hard, shell like box, as hard as the back of a turtle. The tail is supposed to have been, in the lifetime of the animal, its chief weapon of attack or defense. At intervals on the hard, oval surface at the end holes are found, which are supposed to have contained short protuberances, or horns, giving the beast a weapon like a spiked club. Swung with all the strength which an animal as big as the largest elephant of modern times could muster, this armadillo's tail is believed by scientific men to have been more formidable than are now the jaws or claws of a lion or tiger. Another rare



PARIS EXHIBITION.—FACADE OF AUSTRIA AND HUNGARY.

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specimen is a saber toothed tiger, of which there is only one other specimen known in the world, and that is in the museum at Buenos Ayres. The size of the skeleton is about that of a large dog. The teeth are long, like the tusks of a walrus, but their edges are like a knife. This animal is believed to have been of a kind that devoured the sloth. No other use can be imagined by naturalists for the possession of such sharp teeth. Reason is found for this theory in the fact that the surface of a sloth's hide is like the shell of a turtle. The skeleton of the sharp toothed animal is almost perfect. There are twelve different kinds of armadillos in the collection and about eight different kinds of sloths. The size of the sloth skeletons varies from that of a small black bear to the largest elephant. There is no known species of sloth living in the present day whose size comes up to that of the small black bear. There is one specimen in the collection of a very large sloth with the head resembling a compromise between a horse and a rhinoceros—very rare. The saber toothed tiger and the club tailed armadillo are supposed to have ruled the forest in their day. In regard to the question of mastery between them, naturalists believe they "gave each other the path." Also in the collection are specimens of many small animals, dogs, deer, and wild boars. There are the skeletons of ostriches and other large birds. It has not yet been determined to what institution of science this collection will be presented. It was reported that the Academy of Natural Sciences of this city would get them, but Mr. Cope expresses himself undecided between it and the Smithsonian Institution at Washington. The collection is conceded by naturalists to have been the most valuable in the Paris Exhibition. It supplies a gap which has long been wanting in affording a chance to students of this country desiring to study certain kinds of fossils to obtain the knowledge they want without going to Europe.

The Torrey Botanical Club.

The Torrey Botanical Club held its regular meeting at the "Herbarium," Columbia College, Tuesday evening, November 12.

As usual, there were exhibited very many interesting plants, both wild and cultivated. Dr. Gross exhibited a full blown rose, from the center of which another perfect flower had grown. One of the members stated that he had frequently seen the common "bachelor's button" (*Centaurea*) of the gardens in the same median proliferous condition. Dr. Thurber remarked that it was not an uncommon thing to see, in Mexico, some of the *Cacti* with new plants starting out from the side of their fruit. Mr. W. H. Leggett called attention to the recent rediscovery, in North Carolina, of the long lost plant, *Shortia*, by a son of Mr. M. E. Hyams, remarking that the rediscovery of a plant so rare that heretofore only one known specimen existed—that in Michaux's herbarium at the Jardin des Plantes—was one of the most important botanical events of the age. Mr. Leggett also informed the Club that Mr. Thomas Meehan had recently visited the locality in New Jersey given as a station for *Calluna vulgaris*, and had discovered, without the shadow of a doubt, that the plant had been introduced there from cultivation by an emigrant from England. The president, Dr. Thurber, stated that he had discovered that the roots of *Rhexia Virginica* bear tubers, two or three to each root, and resembling minute tubers of the dahlia, a fact that he could find nowhere stated in our manuals of botany, and that this would seem to show that our authorities do not always tell us in their books everything worth knowing about plants. As having a connection with the latter remark, one of the members stated that the fact was perhaps known to nearly every botanist that the red maple is quite constantly dicœcious, and that attention had been called to this not long ago by Mr. Meehan in a communication to the Philadelphia Academy of Natural Sciences, yet the fact is not recorded in our manuals of botany; he stated further that the white maple (*Acer dasycarpum*), although not found wild in the valley of the Hudson, was nevertheless common in cultivation, and in this state he had observed that, when in fruit, one of the wings of the samara was always abortive, and that it was rarely the case a samara had "two large divergent wings," as described in manuals of botany.

Mr. W. R. Gerard called the attention of the Club to his recent detection of a truffle on Staten Island; illustrating his remarks by a large colored drawing of the fungus and its fruit. He stated that truffles had always been regarded as rare in America; but that this was probably owing to the fact that they had not been looked for. Dr. Torrey, in his catalogue of New York city plants, published in 1819, records the edible truffle (*Tuber cibarium*) as found in "Love Lane" (now 21st street). This statement, however, was doubtful, inasmuch as Dr. Torrey, unacquainted with fungi, sent his specimens for naming to Schweinitz, and the latter, in his synopsis of North American fungi, published in 1834, states that he had never met with the plant in this country, but recorded it on hearsay merely. In the Rev. M. J. Berkeley's "Notices of North American Fungi," published two years since in *Grevillea*, he records but a single species—the large-spored truffle (*Tuber macrosporum*)—and that was sent from Pennsylvania by Michener. Mr. Gerard was under the impression, although he was not positive, that he had seen a statement that another species had been detected in California last year. At any rate, the present would seem to be only the third (if, indeed, not the second) authentic account of the discovery of a genuine truffle in this country; and for that reason was a matter of considerable interest. The Staten Island species was found at Huguenot, growing in loamy soil about the roots of alders (*Alnus serrulata.*) The tubers were about the size of a nutmeg, with a firm, smooth, cream-colored skin. The *asci* were nearly orbicular and contained four large, broadly oval, nearly orbicular, reddish brown sporidia. The surface of the latter was covered with a beautiful network of hexagonal reticulations, from the angles of which arose short linear transparent spines, apparently slightly curved at the apex. The species answered pretty well to the description of Tulasne's *Tuber dryophilum*, the wood truffle, and was perhaps that plant. Mr. A. Brown reported the names of two grasses, as an addition to his former list of adventitious plants of New York city; these were the Bermuda grass (*Cynodon dactylon*) and the Egyptian grass (*Dactyloctenium Ægypticum*). He also reported that the name of the composite plant from Hunter's Point, shown at a previous meeting, had been found to be *Flaveria contrayerva*, a South American dye plant.

Dr. Thurber stated that he had recently received from a gentleman in Connecticut specimens of *Nesæa verticillata*, in which the flowers were all double, and that the doubling of the flowers in a state of nature was a thing of rather unusual occurrence. One of the members remarked that he had met with a double-flowered saxifrage in the spring, and another stated that a few years ago he had found specimens of the Rue-anemone (*Thalictrum anemonoides*), in which all of the stamens were replaced by petals, giving the flowers the appearance of dwarf roses.

After the discussion of a few minor matters relating to the local flora, the Club adjourned.

Cashmere Goats in Nevada.

A correspondent of the Baltimore *Sun* writes as follows touching one of the most promising industries of the Far West:

"Pure Cashmere goats find among the wild sage brush (Artemisia) barrens of Nevada an acceptable climate, where their health is excellent and their fleeces unusually fine and silky. A herder near Carson has a flock of 3,000. Eastern farmers (and especially that great multitude who to admiration of rural life do not unite much affection for farm labor) are solicited to give reflection to this intelligence. Here is a whole State, 120,000 square miles, open to superficial preemption, its mountains exactly adapted to climbing goats, and its sweet grass sheltered by every bush of artemisia. Add to this the miraculous winter pasture, more wondrous than the mythic manna of antiquity. Everywhere the flashing leaved white sage abounds. In the growing time of summer no animal can stomach its bitterness. But the first frost that kills the summer food turns this bitterness to sweetest pasture. It is savory and fattening to all animals that herd. It tenders their meat and gives to their coats a glossy fur that defies the frost and the tempests of winter. There is in contemplation of this most wonderful provision of nature more food for thought and more practical instruction than can be found in all the unverifiable superstitions of the world, however eloquently elaborated. Here is inviting occupation, most remunerating, least laborious, most healthful, least risky, and involving small initial outlay, that ought to tempt your surplus workers to cross the wilderness that lies twixt your machine enslaved land and the life inspiriting pursuits of agriculture in this sunny clime—this land of flowers, of perennial verdure, literally overflowing with milk and honey."

Sebastina.

A new explosive material has recently been invented by M. Falmejelm, of Stockholm. The earth or powdery material employed in the composition of common dynamite is substituted here by a species of charcoal, prepared in such a way as to give it considerable absorbing power. The composition of the new explosive substance depends on the purposes for which it is to be used, and the effects which it is desired to obtain. A strong compound, and one in which there is no danger of the separation of the nitro-glycerine, is formed of 78 parts of nitro-glycerine, 14 of wood charcoal, and 8 of nitrate of potash. The proportions vary with the degree of power to be produced. A second quality is formed of 68 parts of nitro-glycerine, 20 of charcoal, and 12 of nitrate of potash.

It is calculated that the increase of effect resulting from the more rapid explosion of this new compound may be estimated at 10 per cent. The proportions of the component parts of the "sebastina" may vary somewhat; but the inventor is of the opinion that these variations should find their limits between 50 and 80 per cent of nitro-glycerine, 15 and 30 per cent of wood charcoal, and 5 and 20 per cent of nitrate of potassa.

Vegetable Tallow.

A patent for artificial tallow was issued in October last to Señor Miguel de la Vega, of New York. Some of our daily papers have stated that the chief constituent of this new compound is obtained from a plant that grows wild in all parts of the continent of America, that the article can be produced for 2 cents a pound, and that the yield is about 70 per cent of the prime materials. But the inventor states in his patent, which we have examined, that 100 lbs. of the artificial tallow is produced by mixing together 60 lbs. of castor oil, 10 lbs. of animal tallow, 10 lbs. of vegetable oil, and 20 lbs. of wheat flour. These ingredients are boiled together for about 30 minutes by steam heat. When the mixture cools it hardens, and resembles tallow. Turnip seed oil, cotton seed oil, or any other similar vegetable oil will answer the purpose equally as well as castor oil.

It is claimed that this compound is equal in most respects to common tallow. It is used for lubricating purposes, for the manufacture of soap, candles, etc., but is not intended to be used in articles of food.

The Carpet Beetle.

A correspondent, living at no great distance from a locality where the ravages of the carpet beetle have been suffered, writes to know if the insects in all their metamorphoses cannot be killed by steam. If so, he proposes to prepare a small tea-kettle with a burner under it, and an India-rubber tube running from the nose, and directing the nozzle, when the steam is made, to all the openings under the mop-board, where the insects first make their appearance, and to other crevices wherein they appear. If the steam issuing from the nose should not be strong enough with a long pipe, the apparatus may be put on castors, and rapidly wheeled round the apartment. If such a contrivance is efficient, the whole land might be cleared of this insect at small trouble and expense.

[We have no doubt that, after the removal of the carpet, the direct application of hot steam to the cracks of a floor infested with the carpet beetle in its various stages, would prove effectual, as our correspondent suggests. But, unfortunately, according to Mr. Lintner (SCIENTIFIC AMERICAN, October 5, p. 218), the insect does not confine its depredations to carpets, nor its dwelling place to floors; it likewise infests closets, trunks, and other out of the way places where the application of steam would prove decidedly impracticable. The benzine remedy proposed by Mr. Lintner, in the article referred to, would seem on the whole to be the best method that we as yet know of to rid a dwelling of these to be dreaded pests.—EDS.]

Canned Food.

A correspondent of the New York *Daily Bulletin* has been making inquiries with regard to the canned goods business, and finds that roast meats are now canned and sold for use on board ship in place of salt provisions. Lobsters were formerly caught off this shore, but they became scarce here and went to Maine, and since then they have gone to Nova Scotia and still later to Newfoundland. Some of our local dealers have had canning factories in Maine, and have moved them as the fish emigrated, and they are now located in Nova Scotia and Newfoundland. Lobster protective laws have been passed by the legislatures, but they came too late, and are even now but loosely enforced.

Among the novelties now put up are baked beans, fish and clam chowder, and the latest of all are fish balls. Beans were first canned as an experiment about a year and a half ago, and some few have been sold in England. The "fish balls and baked beans" were exhibited at the Paris Exhibition, and a great many orders resulted. There have been rumors among the trade that a large contract was secured at Paris from a foreign government (the French) for the supply of the army, but the company manufacturing deny this. The probability is that a sample order has been given, and that if satisfactory a large order is expected. The product received a gold medal at Paris. The works, which are entirely new, are being run to the fullest capacity, and 500 dozen cans of fish balls and baked beans are being made daily.

Soups of all descriptions are canned, but prices for these are high. In fruits much is being done, and peaches and tomatoes are sent to England. Twenty years ago, oysters were canned at the East, but now Baltimore has the trade and turns its advantage of location to good account. The consumption of canned goods is evidently on the increase, and dealers contend that the system of living in flats is tending to increase it, not only on account of room, but because of the slight (and in many cases an entire absence of) preparation for the table. In this connection should be mentioned the kerosene cooking and the kerosene heating stoves, which are accompanying canned goods in their mission of facile and concentrated housekeeping.

An Improved Shot Gun.

We have been shown recently one of the most complete and strongest guns we have ever seen, and as we are often in receipt of letters asking advice in regard to breech-loaders, we think a short description of this gun may interest some of our shooting readers. The piece referred to was made to order for a gentleman of this city by Holland & Holland, of New Bond St., London, a firm whose work ranks with that of Grant, Purdy & Lancaster, but who are but slightly known in this country.

Besides the perfection of the workmanship and beautiful finish, the gun has several novel features that are worthy of notice. The barrel, which is pivoted to the stock, is retained in firing position by three strong fastenings that are operated by a small lever at the top of the stock between the hammers. The cartridge shell ejector, which is of a new form and very substantial, is operated from the barrel joint. Two sets of barrels are fitted to the stock, so that either may be readily removed and replaced by the other. One set of barrels are choke bored for open and long range shooting, while the other is cylinder bored for brush and close work. The gun is inclosed in a chest of English oak, leather covered, and is accompanied with a complete set of loading and cleaning tools.

We are told that notwithstanding the superior quality and finish of Messrs. Holland & Holland's guns, they are furnished at a reasonable price.

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ASTRONOMICAL NOTES.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, December 7, 1878.

The following calculations are adapted to the latitude of New York city, and are expressed in true or clock time, being for the date given in the caption when not otherwise stated:

PLANETS.

	H.M.		H.M.
Mercury sets	5 45 eve.	Saturn in meridian	6 43 eve.
Mars rises	5 01 mo.	Uranus rises	10 39 eve.
Jupiter sets	8 15 eve.	Neptune in meridian	9 16 eve.

FIRST MAGNITUDE STARS, ETC.

	H.M.		H.M.
Alpheratz in meridian	6 56 eve.	Procyon rises	8 07 eve.
Mira (var.) n meridian	9 06 eve.	Regulus rises	10 11 eve.
Algol (var.) in meridian	9 54 eve.	Spica rises	2 52 mo.
7 stars (Pleiades) in merid	10 33 eve.	Arcturus rises	1 54 mo.
Aldebaran in meridian	11 22 eve.	Antares	invisible.
Capella in meridian	0 04 mo.	Vega sets	10 20 eve.
Rigel in meridian	2 03 mo.	Altair sets	9 08 eve.
Betelgeuse in meridian	0 45 mo.	Deneb sets	1 29 mo.
Sirius rises	8 32 eve.	Fomalhaut sets	9 43 eve.

MOON'S PLACE AT 7 P.M.

Saturday, *Aries*	25°	Wednesday, *Gemini*	16°
Sunday, *Taurus*	7°	Thursday, *Gemini*	29°
Monday, *Taurus*	20°	Friday, *Cancer*	12°
Tuesday, *Gemini*	3°		

The moon will pass through the Pleiades or seven stars and occult several of the northern members of the cluster December 8, about 1 o'clock in the morning.

December 6–13 seems to be a well established shooting star epoch; their radiant point being *θ Geminorum*. The constellation *Gemini* is on the meridian December 10, about midnight.

The Saturnian satellite, *Titan*, may, with a small telescope, be seen east of Saturn until December 2 and after December 18, being furthest east December 26, and west of him from December 2 to 18, being furthest west December 10.

Astronomical Notes.

OBSERVATORY OF VASSAR COLLEGE.

The computations in the following notes are by students of Vassar College. Although only approximate, they will enable the ordinary observer to find the planets.

M. M.

Positions of Planets for December, 1878.

Mercury.

The planets which are visible to the naked eye are all in southern declination during the month of December. Mercury is far in the south, rises at 8h. 56m. A.M., on December 1, and sets at 5h. 31m. P.M. It may possibly be seen after sunset. On December 31 Mercury rises at 6h. 28m. A.M., and sets at 3h. 54m. P.M.

Venus.

Venus is nearly as far in the south as Mercury and less favorably situated. On December 1 Venus rises at 7h. 7m. A.M., and sets at 4h. 23m. P.M. On December 31 Venus rises at 8h. 1m. A.M., and sets at 5h. P.M.

It will be seen that Venus keeps very nearly the diurnal path of the sun, and will not be seen during the month.

Mars.

Mars is also very unfavorably situated for evening observers. It rises on December 1 at 5h. 5m. A.M., and sets at 3h. 9m. P.M. On December 31 Mars rises at 4h. 53m. A.M., and sets at 2h. 13m. P.M.

Mars may be seen in the very early morning. It is very small, but can be identified by its red light.

Jupiter.

Jupiter is still conspicuous early in the evening in the southwest. This planet rises on December 1 at 11 A.M., and sets at 8h. 30m. P.M. On December 31 Jupiter rises at 9h. 20m. A.M., and sets at 7h. 4m. P.M.

If we take the hour from 7 to 8 in the evening for observing Jupiter, it will be seen on the 1st with only three of its moons, the one nearest to the planet being behind it, and on the 10th, at the same hour, this satellite is not seen, because it is passing across the face of Jupiter.

Saturn.

On December 1 Saturn rises at 1h. 20m. P.M., and sets 53m. after midnight. On December 31 Saturn rises at 11h. 24m. A.M., and sets at 11h. P.M.

Saturn comes to the meridian between 7 and 5 P.M. all through the month, at an elevation (in this latitude) of about 45°. It is easily recognized, as no bright stars are around it. The belt around it, and the largest moon, Titan, can be seen with a small telescope. The movement of Titan around Saturn and its return to the same place, after intervals of 16 days, can be noticed. It can also be seen to pass on to the face of the planet, and to reappear after it has been hidden behind it. This satellite was seen to pass off the disk on October 24 and again on November 9.

Uranus.

Uranus is in north declination, and therefore crosses the meridian at a good altitude, but in the morning. On December 1 Uranus rises at 11h. 2m. P.M., and sets at 20m. after midnight. On December 31 Uranus rises at 9h. 3m. P.M., and sets at 10h. 21m. of the next morning.

Uranus has passed the star Regulus toward the east, and is now very near one of the small stars of Leo.

Neptune.

Neptune rises on December 1 at 2h. 55m. P.M., and sets at 4h. 25m. A.M. On December 31 Neptune rises at 56m. after noon, and sets at 2h. 24m. of the next morning. Neptune is among the small stars of Aries.

Sun Spots.

The sun has been examined daily from September 22 to November 15. A small spot was perceived on November 4, and its changes were watched for the few following days; it will perhaps be seen again early in December.

Electrical and Telegraphic Inventions and Inventors.

That the United States is prolific of inventors and inventions the records of our Patent Office conclusively prove. In no other country in the world is there so great a number of inventions yearly produced.

In electrical and telegraphic invention there has been recently a very noticeable development. It is a fact that most of the really valuable and important improvements in telegraphic systems and apparatus have, of late years, either originated or been made practical in this country. Electricity has been adapted to public use in a manner and to an extent unknown elsewhere. The improvements in the systems and apparatus employed in commercial telegraphy have largely increased the amount of business which can be done over a single wire, and relatively decreased the cost of doing such business. This enables telegraph companies to serve their patrons at constantly decreasing rates, and thus the telegraph is popularized, and is used by and made beneficial to the public in an increased ratio. The duplex and quadruplex systems have been the most notable inventions in this line, and their practicability and usefulness have been very fully demonstrated. The automatic system, which by many was for some time regarded as a solution of the question of cheap telegraphy for the public, has not as yet justified the anticipations of those who have attempted its introduction. While it may yet be found a useful adjunct to the telegraphic system, as a system of itself it must be conceded that thus far it has been a failure. While as yet the quadruplex is sufficient for the demands of the business, and probably will be for some years to come, when, in the progress of events, a further utilization of the capacity of the conductors for telegraphic transmission shall become a necessity, it is likely that the demand will be met and satisfied. Experiments in this direction are constantly being made, and there would seem to be no reason to doubt of their ultimate success. The telephone as a practical telegraphic instrument is essentially an American invention, and is rapidly coming into general use on short lines and for private telegraphy, for which it is specially adapted.

The fire-alarm telegraph system; the system of telegraphic reports of stock and commercial quotations, on printing telegraph instruments, forwarded to subscribers at their places of business; the domestic or district telegraph system, are all American inventions, and have been exclusively developed and perfected in this country. Our bank vaults, moneyed institutions, and private residences are protected against burglarious assaults, and our buildings against the spread of conflagrations by electrical-appliances of American invention and covered by United States patents. Our places of business, public buildings, and residences are telegraphically connected by apparatus invented, patented, and introduced by Americans, and new adaptations of electrical appliances are constantly enlarging the field of usefulness and convenience of this important agency.

The active and enterprising character of the American people encourages such inventors and stimulates invention by their prompt and ready practical adoption whenever their practicability and usefulness are demonstrated. There is not to be overcome here the prejudice and inertia which exist in older communities, and among peoples who are slow to change the habits and methods of centuries.

The United States has been well characterized as the paradise of inventors. The inventions developed and introduced here slowly but surely force their way in other countries. The country is honored and its material interests advanced by its inventors and inventions, and this fact is now recognized and admitted abroad as well as at home. So long as the telegraphs continue to be owned, operated, and managed as private enterprises this will, in regard to them, continue to be the case. Should they—of which there is at present little probability—ever become an official monopoly, the decrease in the number of telegraphic inventors and of notable inventions will be no less marked with us than it has been in England and in European countries generally, where the telegraphs are owned, managed, and operated as a part of the government machinery and by government officials.—*Journal of the Telegraph.*

Heating Street Cars.

The Third Avenue Railroad Company are experimenting with a steam car heating apparatus which is the invention of Lieut. J. N. Graydon of the U. S. Navy. The invention consists of two cylindrical reservoirs, about 3 feet in length and 16 inches in diameter, placed under the seats on each side of the car. An iron pipe runs from these reservoirs around the car. The reservoirs are so surrounded with non-conducting substances that but little heat escapes from their surface, and a seat directly over a reservoir is no warmer than one in another part of the car. The reservoirs are filled with water to a depth of about two inches, and they are then charged with steam until a pressure of forty or fifty pounds is attained. The reservoirs are tested to stand a pressure of 700 pounds. The steam pressure is maintained during the time required for a round trip from the City Hall to Harlem and return. By an ingenious arrangement of valves constant pressure of steam is kept in the pipes. The reservoirs are to be supplied with steam at the terminus of the line in Harlem and at the Sixty-fifth street depot. Half a minute is required to fill the reservoirs. The cost of warming a car is said to be 2 cents a day.

AMERICAN INSTITUTE FAIR.

Before this paper reaches our readers the American Institute Fair for 1878 will have closed. Taken altogether, it has been successful, although there seems to be a paucity of novelties.

Foremost among objects of interest, especially in the evening, is the electric light. Recently in the interim between the afternoon and evening performance of the machinery the large fountain in the main hall has been illuminated by light projected from an electric lamp in the gallery. Lit in this manner it is a very beautiful object. The Wallace electric lights render the capacious main hall as light as day, and in the machine department the gaslights appear of an orange hue by comparison with the Brush electric light.

A small Brush dynamo-electric machine, recently placed in Machinery Hall, exhibits the immense heating power of a quantity electrical current. A No. 9 wire, 8 or 10 inches in length, is quickly brought to redness, and a smaller wire deflagrates almost instantly.

A rotary pump exhibited by Wilbraham Brothers, of Philadelphia, although compact and not very large, is capable of raising 11 tons of water per minute. These pumps are constructed on the principle of the Baker blower, which is also exhibited by the same firm, and which was illustrated some time since in the SCIENTIFIC AMERICAN. From a careful examination of the moving parts of the pump and blower we can discover nothing subject to greater wear than any ordinary shaft under average conditions.

Among the woodworking machines there are few that differ materially from well known forms. The Concord Buzz Planer, made by John A. White, of Concord, N. H., possesses several points of novelty. In appearance it is the plainest and simplest of machines; it is nevertheless capable of doing a great variety of work. One half of the bed is movable and may be raised or lowered at pleasure. In performing this movement, it is made by an ingenious and simple contrivance to nearly follow the periphery of the planer head. The machine has a simple adjustment, by which it may be arranged to rabbet, bevel, joint, and plane diagonally. The table is supported by a single hollow iron column, so that an irregularity in the floor upon which the machine rests will not twist or spring it.

Another planer from the same manufacturer, having a constantly lubricated bed, works equally well on wet or dry lumber. A novel sandpapering machine, also made by Mr. White, sandpapers bevels, scrolls, etc. The small cylinder which carries the sandpaper for scroll work has, in addition to a rapid rotary motion, a reciprocating longitudinal motion.

The H. B. Smith Machine Company, of Smithville, N. J., exhibit several woodworking machines, among which we find a double tenoning machine having an automatic feed. The work is carried forward between guides by an endless chain carrier which discharges the finished pieces at the back of the machine. While this machine is applicable to all kinds of work, it seems especially adapted to hard wood, as the work is carried steadily up to the knives with a positive feed.

About Advertising.

My success is owing to liberality in advertising.—*Bonner.*

The road to fortune is through printer's ink.—*P. T. Barnum.*

Success depends upon a liberal patronage of printing offices.—*J. J. Astor.*

Frequent and constant advertising brought me all I own.—*A. T. Stewart.*

My son, deal with men who advertise. You will never lose by it.—*Ben Franklin.*

How can the world know a man has a good thing unless he advertises the possession of it?—*Vanderbilt.*

A good advertisement in a newspaper pays no fare on railroads; costs nothing for hotel bills; gives away no boxes of cigars to customers, or merino dresses to customers' wives; drinks no whisky under the head of traveling expenses, but goes at once and all the time about its business free of expense.

Advertising is the oil which tradesmen put in their lamps. They that are unwise put no oil in.

Where is "parts unknown?" asks a correspondent of the *Danbury News.* To which Bailey answers: "Where they don't advertise." And though Bailey does say it, this is no joke.

An advertisement is a window through which all the world may look into your shop and see just what you wish it to see—no more, no less.

People are quite apt to go where their attention is called, and, if they find things as represented, will purchase there in preference to spending their time in seeking elsewhere.—*Phil. Chemist and Druggist.*

An Astonishing Offer.

The *Independent*, of New York, probably the ablest, largest, and best religious newspaper in the world, offers in another column to give away, absolutely, a Worcester's Unabridged Quarto Pictorial Dictionary, which retails everywhere for $10, and is, of course, a household necessity. The *Independent* is now publishing the Rev. Joseph Cook's famous Boston Monday Lectures, which are creating so much discussion everywhere. It will also soon begin the publication of a series of articles on "Socialism and Communism," one of the most important questions of the day, by Ex-Pres. Theo. D. Woolsey, D.D., LL.D. See advertisement of the *Independent* in this paper.

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TO INVENTORS.

An experience of more than thirty years, and the preparation of not less than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. In addition to our facilities for preparing drawings and specifications quickly, the applicant can rest assured that his case will be filed in the Patent Office without delay. Every application, in which the fees have been paid, is sent complete—including the model—to the Patent Office the same day the papers are signed at our office, or received by mail, so there is no delay in filing the case, a complaint we often hear from other sources. Another advantage to the inventor in securing his patent through the Scientific American Patent Agency, it insures a special notice of the invention in the SCIENTIFIC AMERICAN, which publication often opens negotiations for the sale of the patent or manufacture of the article. A synopsis of the patent laws in foreign countries may be found on another page, and persons contemplating the securing of patents abroad are invited to write to this office for prices, which have been reduced in accordance with the times, and our perfected facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Magic Lanterns and Stereopticons of all prices. Views illustrating every subject for public exhibitions. Profitable business for a man with a small capital. Also lanterns for college and home amusement. 74 page catalogue free. McAllister, Mf. Optician, 49 Nassau St., N.Y.

Alcott's Turbine received the Centennial Medal.

1,000 2d hand machines for sale. Send stamp for descriptive price list. Forsaith & Co., Manchester, N. H.

Florey & Smith, San Francisco, make a specialty of introducing useful inventions in the Pacific States.

J. C. Hoadley, Consulting Engineer and Mechanical and Scientific Expert, Lawrence, Mass.

Nickel Plating.—Wenzel's Patent Perforated Carbon Box Anode for holding Grain Nickel. A. C. Wenzel, 114 Center St., New York City.

Correct thing for Holidays, Whist and Dinner Parties, is the Vanity Fair Cigarettes, with your monogram.

Who wrote it?—The question is, who wrote "The Little Belle of Bloomingdale," the realistic story of New York Revolutionary life now running in the *Christian Union*, of New York? We are told it is by one of the most eminent of American writers, and that we have six months to guess it in.

The Genuine Asbestos Steam Pipe and Boiler Coverings are the most durable, effective, and economical of any in use. H. W. Johns Manufacturing Company, 87 Maiden Lane, New York, are the sole manufacturers.

Situation wanted by a Mech. Eng. and Draughtsman. 15 years experience in designing and care of mining machinery, sewing machine tools, and the Corliss engine. Address H. N., No. 131 Vinton St., Providence, R. I.

The well named Leader Lathe is far ahead of competitors. For descriptive circular, address Frasse & Co., 62 Chatham St., New York.

Brush Electric Light.—20 lights from one machine. Latest & best light. Telegraph Supply Co., Cleveland, O.

Steam, Water, Gas, Valves, Hydrants. Prices reduced. Send for catalogue. Chapman Valve M'f. Co., Boston.

Improved Meat Cutter. Capacity 600 lbs. an hour. Circular and price list, J. W. McFarland & Co., Alliance, O.

The Lathes, Planers, Drills, and other Tools, new and second-hand, of the Wood & Light Machine Company, Worcester, are to be sold out very low by the George Place Machinery Agency, 121 Chambers St., New York.

For the best advertising at lowest prices in Scientific, Mechanical, and other Newspapers, write to E. N. Freshman & Bros., Advertising Agents, 186 W. 4th St., Cin., O.

For Town and Village use, comb'd Hand Fire Engine & Hose Carriage, $350. Forsaith & Co., Manchester, N. H.

Manufacturers of Improved Goods who desire to build up a lucrative foreign trade, will do well to insert a well displayed advertisement in the SCIENTIFIC AMERICAN Export Edition. This paper has a very large foreign circulation.

For Power & Economy, Alcott's Turbine, Mt. Holly, N.J.

Brick Presses for Fire and Red Brick. Factory, 309 S. 5th St., Philadelphia, Pa. S. P. Miller & Son.

Punching Presses, Drop Hammers, and Dies for working Metals, etc. The Stiles & Parker Press Co., Middletown, Conn.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

Fine Gray Iron Castings a specialty, also Wire Workers' Pickets and Rosetts in stock. A. Winterburn's Foundry, 16 De Witt St., Albany, N. Y.

Books for Engineers and Machinists. Catalogues free. E. & F. N. Spon, 446 Broome St., N. Y.

Nickel Plating.—A white deposit guaranteed by using our material. Condit, Hanson & Van Winkle, Newark, N.J. English Agency, 18 Caroline St., Birmingham.

H. Prentiss & Co., 14 Dey St., N. Y., Manufs. Taps, Dies, Screw Plates, Reamers, etc. Send for list.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Presses, Dies, and Tools for working Sheet Metals, etc. Fruit and other Can Tools. Bliss & Williams, Brooklyn, N. Y., and Paris Exposition, 1878.

The Cameron Steam Pump mounted in Phosphor Bronze is an indestructible machine. See advertisement

Wheel Press, Cotton Press, Pipe Line, and Test Mercury Gauges. T. Shaw, 915 Ridge Ave., Philadelphia, Pa.

Band Saws, $100; Scroll Saws, $75: Planers, $150; Universal Wood Workers and Hand Planers, $150, and upwards. Bentel, Margedant & Co., Hamilton, Ohio.

Best Turbine Water Wheel, Alcott's, Mt. Holly, N. J.

Bolt Forging Machine & Power Hammers a specialty. Send for circulars. Forsaith & Co., Manchester, N. H.

Jarvis Patent Boiler Setting burns wet peat, screenings without blast. A. F. Upton, Agent, 48 Congress St., Boston, Mass.

For Sale.—A 6 x 6 Upright Yacht Engine, 6 H. P. Wm. F. Codd, Nantucket, Mass.

The most useful improvement for the manufacture of Paper is the recently patented Hot Air Drier of C. S. Clark of this city; taking the paper from the bundle, can finish 3,000 rolls per day, ready for the wall, without handling. W. S. Garrabrant, Agt., 155 W. 29th St., N.Y.

Chapman Valves and Hydrants received the highest award at Mass. Mechanics Fair. Chapman Valve Manuf. Co., Boston, Mass.

For Solid Wrought Iron Beams, etc.. see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Machine Diamonds. J. Dickinson, 64 Nassau St., N.Y.

Vertical & Yacht Engines. N.W. Twiss, New Haven, Ct.

The Lawrence Engine is the best. See ad. page 365.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Eagle Anvils, 9 cents per pound. Fully warranted.

Kreider, Campbell & Co., 1030 Germantown Ave., Phila., Pa., contractors for mills for all kinds of grinding.

The only Engine in the market attached to boiler having cold bearings. F.F. & A.B. Landis, Lancaster, Pa.

Hydraulic Cylinders, Wheels, and Pinions, Machinery Castings; all kinds; strong and durable; and easily worked. Tensile strength not less than 65,000 lbs. to square in. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

Engine Lathes, 8 ft. bed, 19 in. swing, on hand and finishing; price low. F.C. & A.E. Rowland, N. Haven, Ct.

NEW BOOKS AND PUBLICATIONS.

GROWTH OF THE STEAM ENGINE. By Prof. Robt. H. Thurston, A.M., C.E., Stevens Institute. New York: D. Appleton & Co., 12mo. pp. 490.

In this volume of the International Scientific series Professor Thurston has traced the history of the gradual development of the philosophy and construction of the steam engine, from the simple machine of Hero (B. C. 200) down to the steam engine of to-day. The work is intended for popular reading, and is well illustrated.

THE SOUTH PASS JETTIES. By E. L. Corthell, Resident Engineer. Transactions of the American Society of Civil Engineers. 1878.

In this essay, read before the tenth annual convention of the American Society of Civil Engineers last June, Mr. Corthell has given a sketch of the progress of the improvement of the mouth of the Mississippi, with incidental notes and memoranda. The information he gives will be found of interest and value to engineers who have to deal with such problems.

SLIDE VALVE GEARS. By Hugo Bilgram, M.E. Philadelphia: Claxton, Remsen & Haffelfinger. pp. 125. $1.

In this brief essay Mr. Bilgram offers a new graphical method for analyzing the action of slide valves moved by eccentrics, link motions, and cut-off gears. It is offered as an easy means for properly designing valves and valve gears, and for establishing the comparative merits of their various constructions. His method is a modification of Zeuner's diagram, calling for no knowledge of mathematics beyond elementary geometry.

THE RELATIVE PROPORTIONS OF THE STEAM ENGINE. By William D. Marks. Philadelphia: J. B. Lippincott & Co. 12mo. pp. 161.

In this course of lectures to the students of dynamical engineering in the University of Pennsylvania, Professor Marks has undertaken to give, in a simple and practical form, rules and formulæ for the determination of the relative proportions of the component parts of the steam engine.

CASTING AND FOUNDING. By N. E. Spretson. New York: E. & F. N. Spon. 8vo. pp. 412. Eighty-two plates

The author's object has been to furnish a practical treatise on casting and founding, including descriptions of modern machinery employed in the art. Little space has been given to chemical or metallurgical theories. The work is well illustrated and has a good index.

TRIGONOMETRICAL LEVELING. By August Faul, C.E. Baltimore: Cushings & Bailey. 8vo. pp. 46.

This short treatise on leveling by vertical angles, and the measurement of distances by telescope and rod, is supplemented by a valuable set of tables of heights for all angles from zero to 22½°, in minutes, and for any distance.

THE STEPPING STONE TO ARCHITECTURE. By Thomas Mitchell. New York: A. J. Bicknell & Co. 32mo. pp. 83. 60 cents.

This little catechism of architecture is intended to explain in simple language the principles and progress of the art from the earliest times. Its illustrations are from Gwilt's "Encyclopedia of Architecture."

FLOWER OBJECT LESSONS. From the French of M. Emm. Le Maout. New York: W. J. Read. 1873.

Properly used this little book may be of use to primary teachers; it will hardly bear comparison, however, with the elementary works of Gray, Youmans, and Wood. There is no gain, we are inclined to think, in an excessive avoidance of technical terms. A child will learn to use and understand the word stamen, for example, quite as readily as powder wand.

SOUND. By Prof. Alfred Marshall Mayer. New York: D. Appleton & Co.

This is a companion volume to Professor Mayer's excellent little work on Light, and presents the same features. By means of a series of simple and inexpensive experiments that any bright boy can make, a thorough, though necessarily limited, knowledge of sound and its principal phenomena and laws, is pleasantly sketched. It is a guide book for experimental study, and is accordingly scientific in its spirit, as well as in its facts, and calculated to develop the habit of scientific thinking on the part of the student.

LESSONS IN ELEMENTARY CHEMISTRY. By Henry E. Roscoe, B.A., F.R.S. London and New York: Macmillan & Co. 1878.

This is a new edition of Professor Roscoe's admirable little book. The combining weights of the elements are calculated from the results of Stas's experiments, oxygen being taken at 15·96 instead of 16, as in the previous edition.

Journal of the Cincinnati Society of Natural History. No. 2. 1878.

This flourishing society, located in a city which has given its name to a highly fossiliferous group of rocks belonging to the lower silurian system, is peculiarly and favorably situated for palæontological studies—studies which, judging from the journal before us, are being pushed with great vigor. Mr. Wetherby contributes a classified list of fossils from the Cincinnati group; Mr. Ulrich makes observations on fossil annelids, and describes new species from the Cincinnati group; Mr. Miller describes eleven new species from the same formation; Mr. Moore gives the annual precipitation of rain for forty-two years; and the society's proceedings occupy the rest of the number. Two plates, illustrating new fossils, accompany the text.

Notes & Queries

S. G.—"Land and Marine Engines and Boilers," Burgh.—E. H. M.—The universal square may be used as a try-square, T-square as a graduated rule, for laying out a miter, and for finding the center of a circle.—W. H. J.—Consult our advertising columns.—E. B. should address a manufacturer of hydraulic rams.

(1) C. Q. asks: At what height above a boiler shall I place a water reservoir so that the boiler may be supplied with water from the reservoir by the force of gravitation alone? A. The pressure is about 0·433 lb. per square inch for each foot of difference of level, between water lines in boiler and reservoir respectively.

(2) J. F. A. asks how phloroglucin is made. A. Phloroglucin ($C_6H_6O_3$) is produced by heating phloretin, quercetin, dragon's blood, gamboge, kino, etc., with caustic potassa. Rhombic crystals, with two molecules of water of crystallization, of sweet taste.

What is the latest work on gasometry? A. The latest work on gasometry is *Gasometrische Methoden*, by Robert Bunsen, 2 Auf., 1877.

Is there a work on the barometer and its application to chemical analyses? A. We have not seen such a work.

(3) W. F. M. asks what to size chromos or oil prints with before varnishing. A. You may use a thin solution of fine glue, isinglass, or starch.

(4) W. W. asks: 1. How to make a marking ink for marking linen, cotton, etc., that requires no warm iron, heating, or preparation after being written? A. Dissolve shellac in a little water by boiling it with about one sixth part of borax, and add to this solution a sufficient quantity of soluble nigrosin to produce the proper color. 2. How can I make aniline black in solution that will keep for any length of time without decomposing? A. Add to the solution a little alum or borax.

(5) D. J. M. writes: In your issue of November 2, 1878, you say the decimal system of numeration is not the best system. Will you please tell what system you think better, and why? A. The duodecimal, since the unit is divisible into more convenient fractions.

(6) P. T. A. asks: 1. Can you give a recipe for welding horn? A. Pieces of horn may be joined by heating the edges until they are quite soft, and pressing them together till they are cold. 2. Also a recipe for staining horn? A. To stain horn red, soak in very dilute nitric acid for a few minutes, and apply a strong infusion of cochineal in aqua ammonia. Green, steep in a solution of 2 parts of verdigris and 1 of sal ammoniac. Blue, stain green, and then steep for a short time in hot soda solution; or steep them for a short time in a weak solution of sulphate of indigo containing a little cream of tartar. Yellow, steep them in solution of lead acetate, and then, after drying, in solution of bichromate of potash. Purple, use a strong aqueous solution of gold chloride. Black, use nitrate of silver and expose to sunlight. Brown, immerse in aqueous solution of potassium ferrocyanide, dry, and treat with a hot dilute solution of copper sulphate.

(7) M. asks why a small driving wheel is used on a locomotive instead of a large one to draw the heavy freight trains? A. With the smaller drivers the piston of the engine has a greater leverage over the load.

(8) J. H. C. asks whether the electrical light produced through the medium of platinum wire or charcoal points is attended with intense heat at the points of illumination. A. Yes, the heat is very intense, capable of fusing or volatilizing almost every known substance.

(9) J. F. B. asks: When it is twelve o'clock noon at Greenwich (say Sunday), what time is it, and what day, at the same instant 180° east or 180° west of that place? A. As no civilized people live along that line the question is of no practical importance, and no rule has been established with regard to what the actual date is. Mariners sailing east drop a day from their reckoning, those sailing west add a day, on crossing that line, to make their date correspond with those of the people they next come in contact with.

(10) A. H. asks: 1. Are the best horseshoe magnets cast or forged into shape? A. Forged. 2. What kind of steel makes the most powerful magnets—spring, tool, machine, Stubs, or cast steel? A. When tempered so as to be as hard as good tool steel tempered to a dark straw color, either will do. 3. Can I magnetize my magnets as effectually with an electro-magnet as with methods described in No. 142, SCIENTIFIC AMERICAN SUPPLEMENT, in article entitled "How to make a Working Telephone"? A. No.

(11) B. L. writes: We have an ordinary single action pump, 3 inches bore and 6 inches stroke, raising water 31 feet: from well to pump is 10 feet, and from pump to tank 21 feet, both measured vertically. The suction and discharge pipes are both one inch diameter. If the pipes are increased to 1¼ inch diameter what per cent of power will be saved, speed of pump 30 strokes per minute? A. We do not think there would be much gain.

Is there a paper published in this country similar to the *Textile Manufacturer*? A. We think not.

(12) S. P. L. writes: If at a given time all the inhabitants of the earth, with all animals, locomotives, steamers, etc., take up a line of march due east, what will be the effect on the motion of the earth on its axis? A. As the total mass of everything movable on the face of the earth is infinitely small compared with the mass of the earth, we think there would not be the slightest disturbance.

(13) W. M. M. asks: Is there such a thing as a perfect vacuum? A. No; but the Torricellian vacuum is practically perfect. Every mercurial barometer presents an example of it.

(14) B. F. K.—The moist pile is not adapted to the electric light. Better use 10 or 15 cells of Bunsen battery. For a primary coil use two layers of No. 16 wire, on this wind several thicknesses of paper previously soaked in melted paraffin, and on the paraffin paper wind the first layer of your No. 32 wire. Put paraffin paper between the layers of the fine wire. You cannot get a satisfactory light from an induction coil.

(15) R. W. asks: In pumping water into the top of a steam boiler, can it be done without putting the feed pipe down into the water in the boiler? A. You may do it, but it would be disadvantageous, as it would condense more or less of the steam.

(16) G. S. L. writes: Two hydraulic rams, constructed precisely alike, are in operation at the same time, taking their water from the same source of supply, and discharging at the same elevation. The head of water is the same in both cases (5 feet), but ram No. 1 is located directly beneath the source of supply, while No. 2 is distant 100 feet down a hill (but only 5 feet below the source of supply). Now, will either of these rams raise more water than the other, and will either make more strokes per minute than the other? Will the long column of water, being heavier, acquire more momentum, and can it perform more work, than the short perpendicular column in ram No. 1? A. We think that the best results will be obtained from the long column.

(17) G. S. asks: 1. At what point should the fire line be in relation to the water line of a plain cylindrical boiler? A. Not lower than midway. 2. Would it injure the boiler to have the gas work all around it? A. No.

(18) W. C. E. asks how academy or mill board, which is used by artists, is made. A. Size pasteboard, and when dry apply a thick coat of paint with a palette knife. If a rough surface is desired, paint two sheets of board, put them face together while green, then pull them apart immediately.

(19) J. H. asks how to make carburet of sulphur. A. A porcelain tube filled with pieces of charcoal which have been recently heated to redness in a covered crucible, is fixed across a furnace in a slightly inclined position. Into the lower extremity a tolerably wide tube is secured by the aid of a cork; this tube bends downward, and passes nearly to the bottom of a bottle filled with fragments of ice and a little water. The porcelain tube being heated to a bright redness, fragments of sulphur are thrown into the open end, which is immediately afterwards stopped by a cork. The sulphide of carbon formed passes over, is condensed by the ice, and collects at the bottom of the vessel. This is collected and freed from sulphur by redistillation at a very gentle heat in a retort connected with a good condenser. For preparation on a large scale, a tubulated earthen retort is filled with charcoal, and the sulphur is dropped in through a porcelain tube passing through the tubulure and reaching nearly to the bottom.

(20) J. B. asks how to make canvas waterproof and pliable. A. Without altering its appearance or pliability canvas may be made water repellent by saturating it with a boiling solution of soap, pressing out excess of this, and then submitting it for a short time to the action of a hot bath of alum, aluminum sulphate or acetate, or lead acetate.

(21) E. H. asks for directions for filling the grain and polishing black walnut mouldings. A. Apply several good coats of alcoholic shellac varnish, and when dry rub down with a little pumice powder moistened with water. Then apply a flowing coat of French spirit copal varnish.

(22) E. S. asks to what extent power can be conveyed by electricity. In other words, is or would it be possible to convey sufficient power, by means of an electric current, from the Falls of Niagara to Hamilton, Ont., to turn a mill? A. About 50 per cent of the power may be sent over short distances. As the diameter of the conductor must increase with the distance, it would be practically impossible to transmit power by this means through the distance named.

(23) C. S. R. says: I am making a paper canoe, and want a waterproof glue to paste strips of thin paper together with. How can I make it at a small cost? A. Try the following: Clear pitch, 20 parts; boiled oil, 30 parts; litharge, 3 parts; mix thoroughly while hot. Applied hot in very small quantity, using a rubber.

I have a telephone of my own make, cigar boxes with a parchment disk, working over 200 feet of common twine. Could the twine be replaced by fine brass wire to resist the weather better? A. Wire may be used, but it generally gives unsatisfactory results. The cord may be protected from the action of the weather by saturating it with strong, hot solution of soap, and, after pressing out the excess, boiling it in a strong solution of aluminum or lead acetate.

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(24) G. F. P. asks: 1. Will steel castings answer for large horseshoe magnets? A. We do not know that steel castings have been tried for this purpose. We think, however, that they would answer. 2. How large a horseshoe magnet shall I use for a magneto call bell engine on a telephone line 1,000 feet long? A. Use an 8 inch. 3. I think of having the permanent magnet to revolve in front of the electro-magnet, instead of the reverse, as is usually done. Will this be attended with any disadvantage? A. Jarring works injury to permanent magnets. 4. In the modified form of Bell telephone with compound magnet ending in a soft iron core, how is the core attached, and how long is it? A. The flattened end of the core is clamped between the magnets. It should be about 2 inches long.

(25) G. F. B. asks for a simple way by which to determine the resistance of the rheostat, described in SCIENTIFIC AMERICAN of November 9, 1878. A. Use a galvanometer.

(26) H. J. R.—The pressure of water is about 0·433 lb. per square inch per foot of depth.

(27) W. L. L. asks: 1. Are not the climatic zones constantly but slowly changing their position on the surface of the earth, and if so, in what direction do they move? A. Has been asserted; evidence insufficient. 2. Can you explain why it is, at least navigators say so, that there is a greater field of ice and more dense at the South pole than that of the North? A. The southern hemisphere does contain more ice; attributed to greater land masses and higher elevations about the South pole. 3. When the earth is nearest the sun in December, what part of the globe's surface receives the most direct solar rays? A. South torrid zone. 4. When and by whom was this planet of ours named earth? A. Earth is an English word from the early Saxon. There is no means of telling how old the word is.

(28) J. B. D. asks: Will a cannon ball shot directly up acquire as great a velocity in falling as is imparted to it by the force of the powder; in other words, that it will strike the ground with the same velocity and force that it leaves the gun? A. If the shot were fired in a vacuum it would have equal velocities of ascension and descension. The resistance of the air impedes the shot.

(29) D. H. E. asks (1) how to proportion gin running gear. The mule track is 30 feet in diameter, cast iron segments 9 feet diameter, pinion 18 inches, and gin pulley 9 iuches in diameter. What size shall the band wheel be to drive the gin 150 revolutions per minute, and let mules travel 3 miles per hour? A. About 6 feet 9 inches. 2. Is there any difference in the power required, speed of gin being the same, to have a large cog wheel and small band wheel or a large band and small cog wheel? A. There is no essential difference, as we understand you.

(30) J. M. asks for the easiest way to magnetize small steel bars. A. Place the steel bar within a helix of copper wire through which passes the current from several Bunsen or bichromate cells for a minute or two; then interrupt the current and remove the magnet. Full directions in SCIENTIFIC AMERICAN SUPPLEMENT No. 142, in "How to make a Telephone."

(31) J. H. K. asks: What kind of metal is best to work in cream with, on churn dashers for example? A. Well tinned iron is good, but wood for many reasons is preferable to metal of any kind.

(32) W. H. S. asks what material to use in making flexible tubes for conveying air which is hot enough to render a room uncomfortable. A. Canvas tubes, saturated with strong aqueous solution of sodium tungstate and dried might fulfill the requirements, as we understand them.

(33) J. H. D. writes: We regulate the pressure of the street gas between the main and meter. Would it not be advantageous to the consumer to have a regulating lock? Just inside of the meter allow full pressure on the meter (a dry one) from the company's gasometer. Is gas compressible? If so, would it not pack slightly in the meter under the gasometer pressure? A. The density of gas is influenced both by pressure and temperature. Little if any advantage would result from the arrangement proposed, under ordinary circumstances.

(34) W. S. W., Jr., and others, who ask how to detect gold in sulphurets, etc. A. See Plattner's "Manual of Qualitative and Quantitative Analysis with the Blowpipe," pp. 318, 320, and 422. In practice, the most satisfactory method of detecting very small quantities of gold in such ores is as follows: Reduce the whole of a sample of several ounces of the ore, by grinding, to an impalpable powder, that will pass readily through an 80 mesh sieve; mix about a drachm of the well mixed powder with ten times its weight of pure lead and one or two fragments of borax glass the size of peas, place in a scorifier and expose in a closed muffle to bright red heat until the lead is all fused and the ore floats on top; then open the muffle and let a current of air pass slowly over the red hot scorifier and its fused contents until the ore has been absorbed and the fused metal has disappeared beneath a covering of litharge; then remove, cool, break, remove and clean the lead button, and place it carefully in a heated cupel weighing somewhat more than the bead; when the lead has melted the muffle is opened and air allowed to pass over the fluid mass until the lead has all been converted into litharge, and the litharge absorbed by the cupel, leaving the gold and silver behind; if the bead is white, silver is present; add about twice the weight of the bead of pure silver, fuse together with the blowpipe flame on a charcoal support, flatten while hot on an anvil, and heat for some time to boiling with pure nitric acid, which dissolves the silver, leaving the gold, if any were present in the ore, as a brownish black mass, which shows the characteristic luster when pressed with a knife blade, and when brought into contact with a drop of aqua regia, and then with a crystal of stannous chloride develops a purplish-red, violet, or brownish-red coloration—purple of Cassius.

(35) L. J. O. and others.—We intend publishing at an early date in the SCIENTIFIC AMERICAN SUPPLEMENT a description of a telephone call.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

G. H.—No. 1 is chiefly quartz and iron sulphide. No. 2. The fragment contains a little gray copper. No. 3 is a variety of bituminous coal. No. 4 is iron sulphide with a little copper. Nos. 5 and 6 are principally iron sulphide. No. 7 contains lead sulphide. Some of this may contain silver.—F. F.—The white pebbles are quartz; the rest are jasper. Of little value.

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COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges with much pleasure the receipt of original papers and contributions on the following subjects:

A Voltaic Pile. By M. G.

HINTS TO CORRESPONDENTS.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Many of our correspondents make inquiries which cannot properly be answered in these columns. Such inquiries, if signed by initials only, are liable to be cast into the waste basket.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

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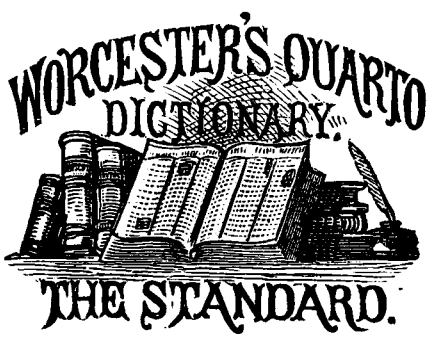

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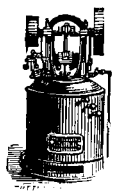

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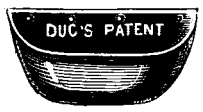

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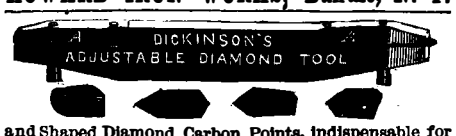

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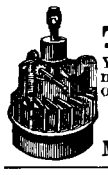

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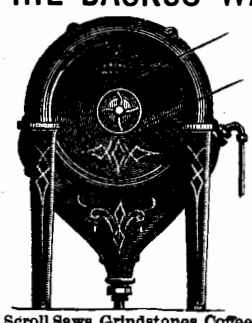

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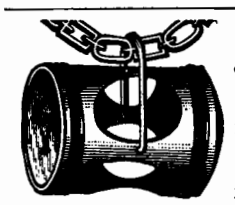

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